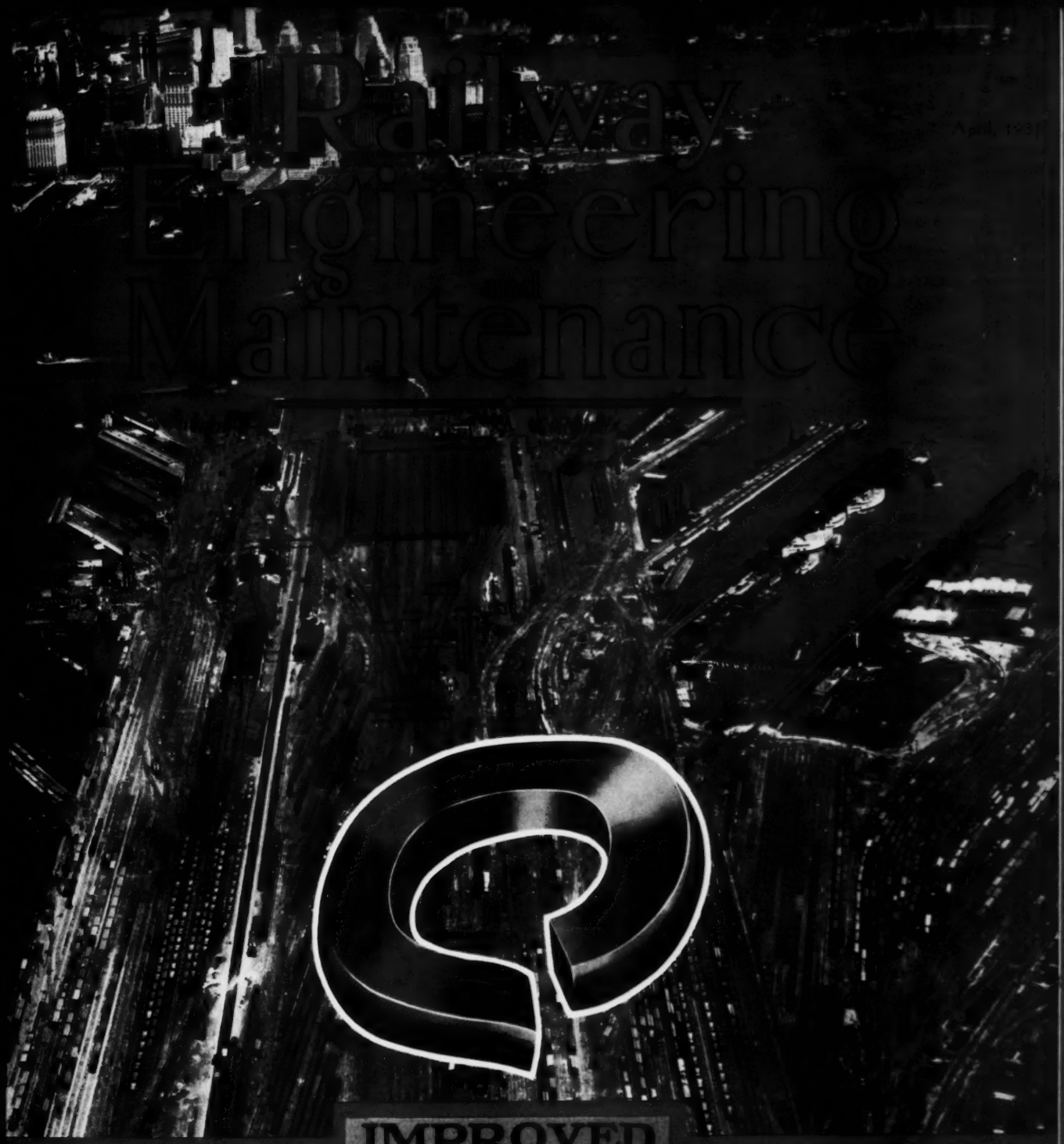

IMPROVED HIPOWERS

ARE NEVER FLAT UNDER 30,000 POUNDS PRESSURE, nor will they be flat under the heaviest pressures to which they will be subjected in track.

THEREFORE: They *can* and *always do* function as shock absorbers to eliminate destructive impacts of traffic. They are never inert fillers.

THE NATIONAL LOCK WASHER COMPANY
Newark, New Jersey, U. S. A.

You *can't* abolish maintenance

. . . but you can reduce your costs

MAINTENANCE engineers who have specified HY-CROME for years know that the only means of automatic compensation for wear ever devised that is practical and economical is the helical spring washer. Exhaustive tests over an adequate period convinced them of its permanent and non-fatiguing reactive pressure over a wide range of reaction, definitely reducing the number of maintenance inspection periods and making replacements unnecessary.

HY-CROME maintains proper rail joint rigidity unaffected by temperature changes and is non-fatiguing under the wheel impact of the heaviest, fastest trains operated today. Maintenance engineers keen to reduce costs are invited to make us prove that HY-CROME will do it.

THE
RELIANCE MANUFACTURING CO.
MASSILLON, OHIO
Engineering Materials, Ltd., McGill Bldg.
Montreal, Quebec, Canada

HY-CROME
Reg. U. S. Pat. Office

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Publishing Co., at 2200 Port Washington Road, Milwaukee, Wisconsin. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered as second class matter February 14, 1931, at the postoffice at Milwaukee, Wisconsin, under the Act of March 3, 1879.

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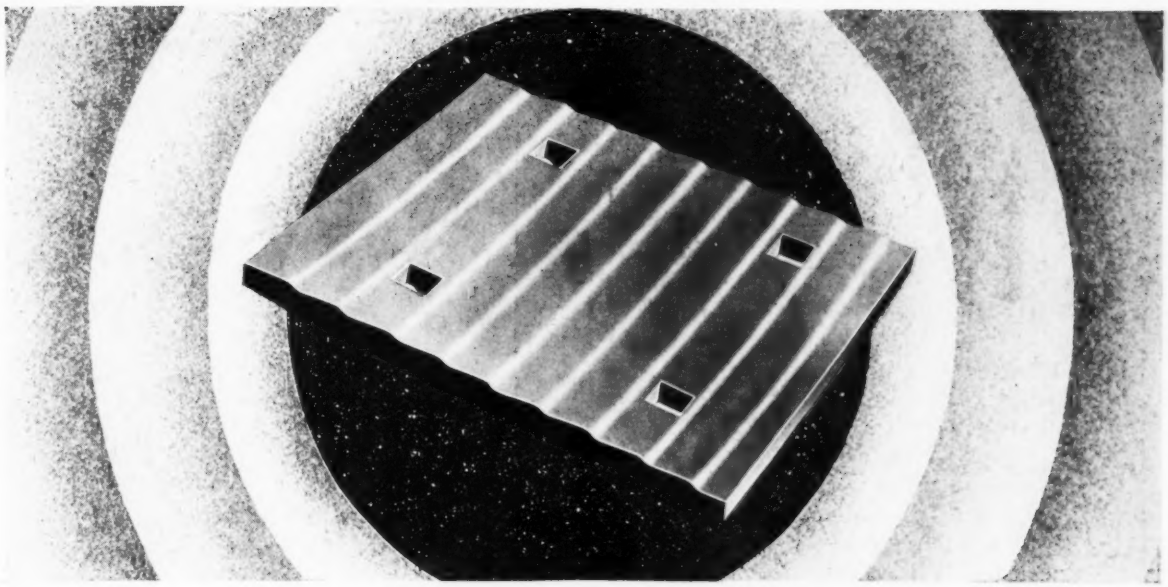


LUNDIE TIE PLATE

The
LUNDIE
TIE PLATE
answers one of
the major problems
of present day track
maintenance without the
heavy expense involved in
making radical changes in present
construction methods.

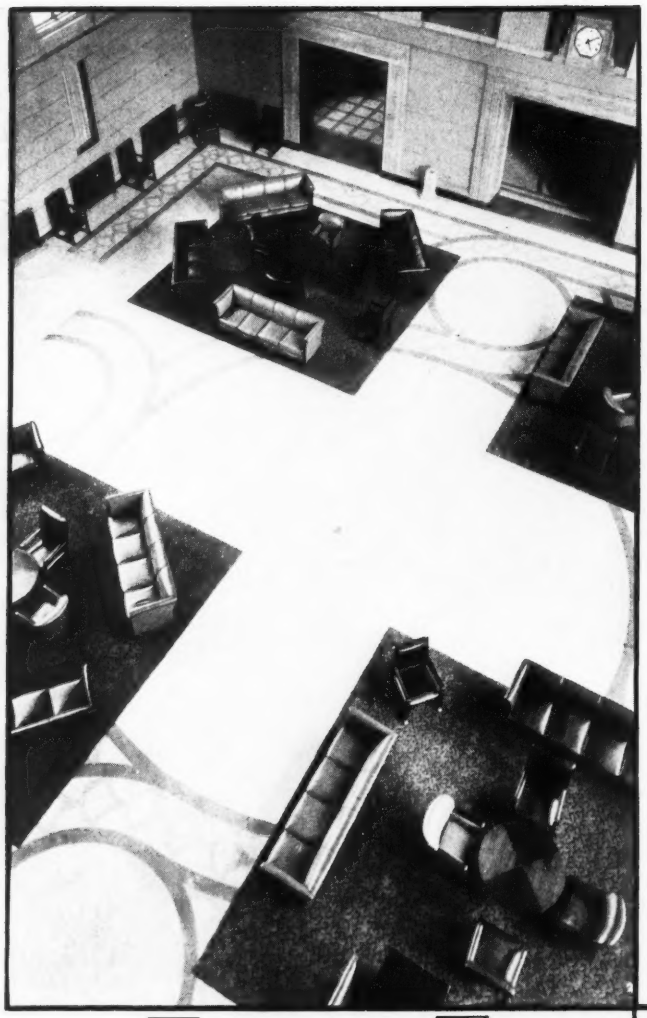
LUNDIE TIE PLATES lend themselves ideally to fastening to the ties with either lag screws or spikes independent of the spikes that hold the rail. A further refinement is thus added to a tried and proven track design for merely the extra cost of either lag screws or additional spikes.

THE LUNDIE TIE PLATE offers a design that eliminates tie destroying projections and is not encumbered with any attachments.

The Lundie Engineering Corporation

285 Madison Avenue, New York
59 East Van Buren St., Chicago

HOLDS GAUGE WITHOUT TIE DESTRUCTION



WHERE are the Benches?

BELIEVE it or not—this isn't the lounging room of an exclusive club, but the waiting room of a railroad station! The overstuffed leather divans, luxurious rugs and walnut tables strike the keynote of the magnificent new Burlington Station, built to give Omaha the finest of terminal facilities.

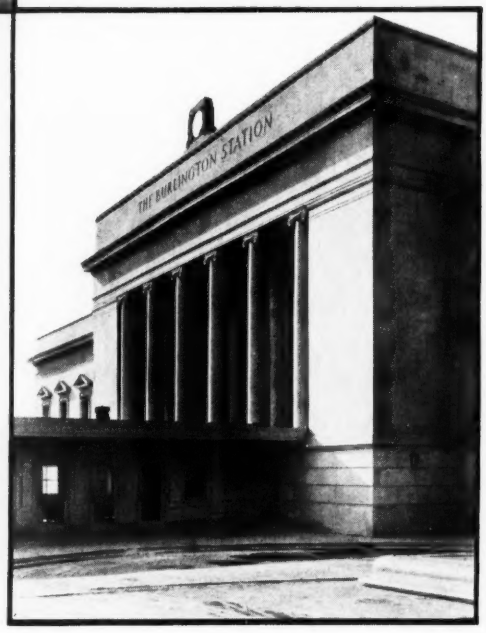
In improving an already high standard of service, the Burlington Railroad chooses an appropriate way to commemorate eighty years of remarkable growth.

No. 4 of a Series Contributed by Leading Railroads

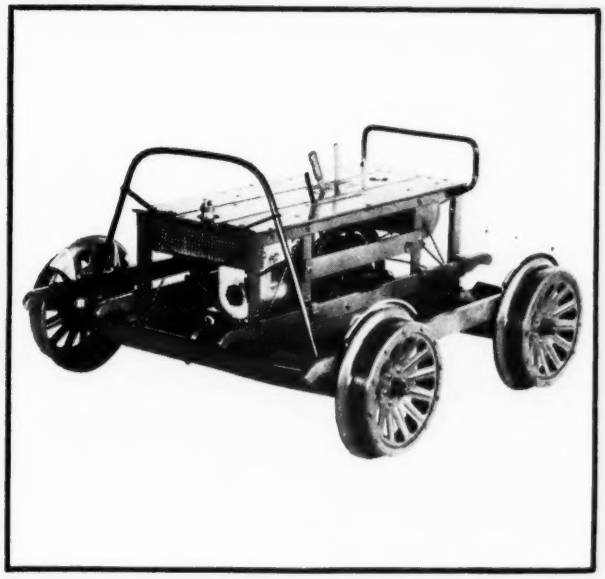
Eighty years ago the Burlington started in business at Aurora, Illinois, with twelve miles of track, a wood-burning "teakettle" engine, a second-hand coach and two borrowed freight cars.

Sixty years ago the Burlington pushed across the Missouri River into Nebraska to seek fortune in a land of doubtful possibilities.

Today the twelve miles of track have become 9,400, embracing a vast, prosperous empire of eleven states . . . Measure the success of the Burlington, and you have measured the swift growth of the Middle West it helped to build.



THE RAILROAD WORLD



Fairmont M19 Inspection Car

Spring mounted frame makes this car popular for long inspection trips. It comfortably seats 1 to 4 men. Extension handles reduce lifting weight to only 150 lbs.

A RECORD

that Outranks All Claims . . .

Over half the railway motor cars in service are Fairmont products. What made this surprising record possible?

Superior products and service, for one thing—*and a complete line.*

Speed is necessary for Inspection Cars, but obviously not so necessary in Section Cars. Power is of utmost importance in discing, but secondary to other performance factors in light section car service . . . Thus, nearly every use of the railway motor car calls for separate, distinct engineering requirements.

Fairmont alone has recognized this. Fairmont alone offers a complete line. A line so carefully planned, so finely built, so complete in every detail, that every railroad need finds a "tailor-made" answer. That is why each Fairmont model operates on the lowest basis of "Over-all Cost", and Fairmont cars are in the great majority.

Your inquiry about any Fairmont product is met by a *record,* not by claims.

Fairmont Mudge

Performance on the Job Counts

FAIRMONT RAILWAY MOTORS, INC.

FAIRMONT, MINNESOTA, U. S. A.

General Sales Offices:

1356 Railway Exchange Bldg., CHICAGO

District Sales Offices:

New York City Washington, D. C. St. Louis

San Francisco New Orleans

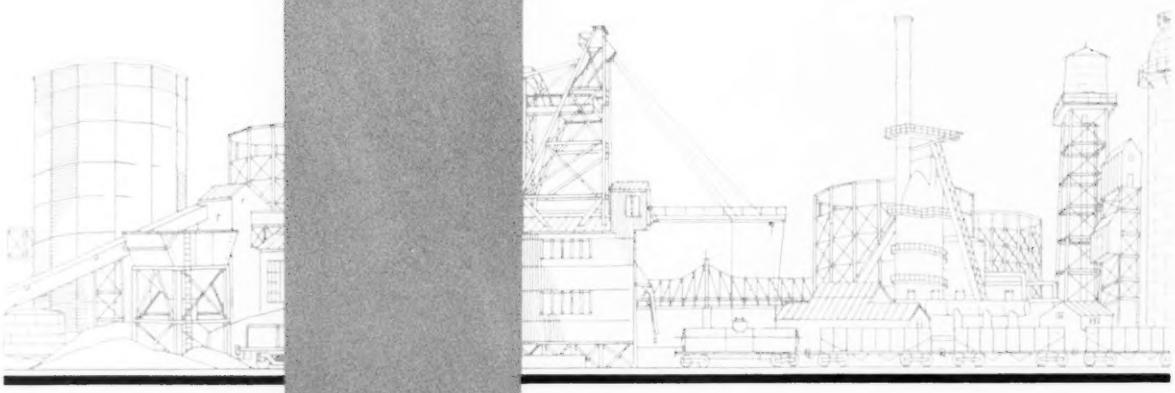
FAIRMONT RAILWAY MOTORS, Ltd., Toronto, Canada

Foreign Representative: THE BALDWIN LOCOMOTIVE WORKS

Manufacturers of section motor cars, inspection motor cars, gang and power cars, weed burners, mowers, ballast discers, ball and roller bearing engines, push cars and trailers, roller axle bearings, wheels, axles and safety appliances.

K N O W S F A I R M O N T

WHERE RED SIGNALS SAFETY. . .



"DEPRECIATION" is a common enough word in accountants' reports, financial statements, and the like. But to the engineer and maintenance man, "depreciation" is more than a word—it's real . . . a steadily working, destructive force that must be checked if valuable property is to be conserved.

Red signals safety to those who are fighting depreciation in metal structures. Their own experience and the experience of their particular industry show the need for using pure red-lead to fight depreciation . . . to protect metal structures against air and moisture—the cause of corrosion.

Red signals safety when the red is Dutch Boy Red-Lead. It's a fine, uniform, highly oxidized pigment which makes paint that sticks tight to metal. It makes a paint that works easily—that protects better—that wears longer.

Dutch Boy Red-Lead comes in both paste and liquid forms. The paste—Dutch Boy Red-Lead in oil—is the natural orange-red and can be readily shaded to darker colors. Dutch Boy Liquid Red-Lead is supplied in six colors—orange-red, two shades each of green and brown, and black. Let our Department of Technical Paint Service help you solve your metal painting problems. Ask our nearest branch for booklet—"Structural Metal Painting".

NATIONAL LEAD COMPANY

New York, 111 Broadway; Buffalo, 116 Oak Street; Chicago, 900 W. 18th Street; Cincinnati, 659 Freeman Avenue; Cleveland, 820 W. Superior Avenue; St. Louis, 722 Chestnut Street; San Francisco, 2240 24th St.; Boston, National-Boston Lead Co., 800 Albany St.; Pittsburgh, National Lead & Oil Co. of Pa., 316 Fourth Avenue; Philadelphia, John T. Lewis & Bros. Co., Widener Bldg.

DUTCH BOY RED-LEAD

THESE FEATURES are worth more!

The Patented Crawler Base that gives positive traction even while turning.

* * *

The "feather-touch" clutch control.

* * *

The helical gear drive.

* * *

Slow speed power plants on spring mountings.

* * *

Ball or roller bearings on all high speed shafts.

* * *

A forged steel center pin that takes the strains off the travel shaft.

No other shovel, crane or dragline offers the railroad man as many money-making, time-saving advantages as the Northwest.

To equal a Northwest every other manufacturer would have to add the "feather-touch" control, the helical gear drive, a steering device that assures positive traction on both crawlers even while turning, a *forged steel* center pin, a *slow speed,* heavy duty power plant, and many other valuable features.

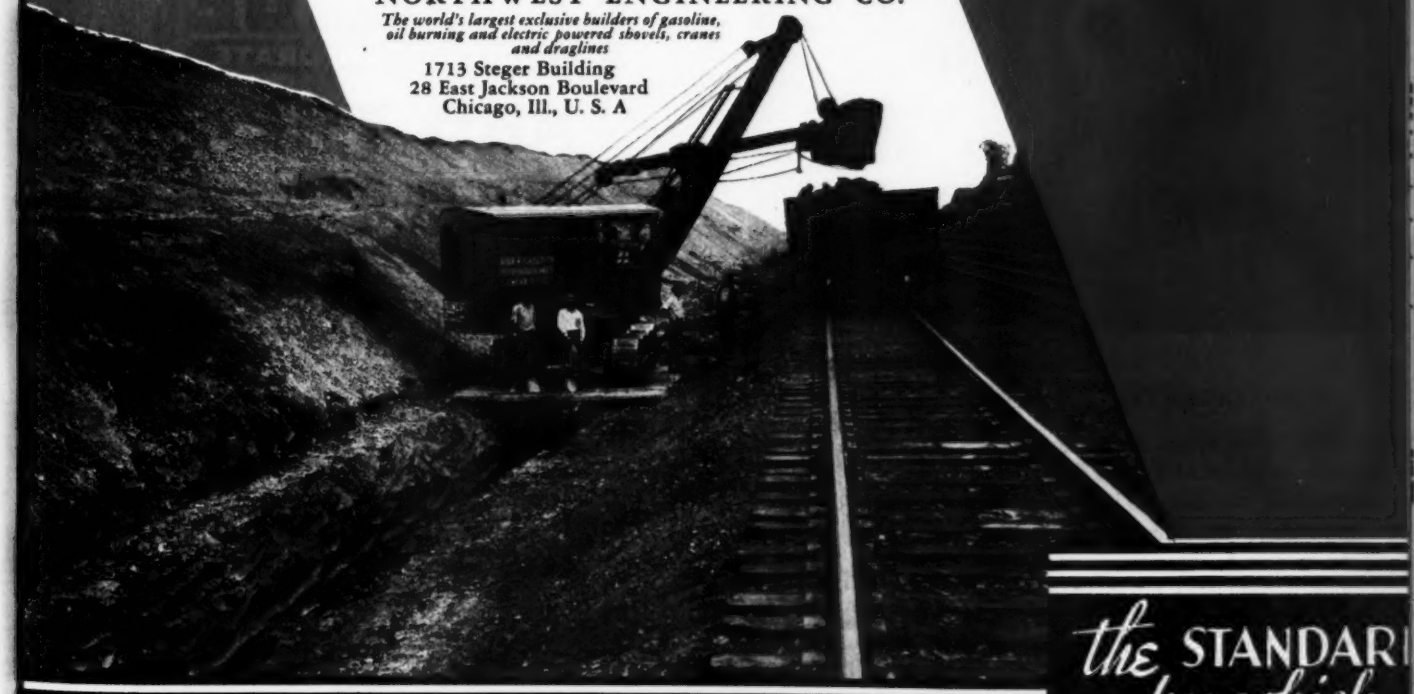
These features are worth more! They are the reasons why 42% of the crawler machines on American Railways are Northwests.

Ask what they mean to you!

NORTHWEST ENGINEERING CO.

The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines

1713 Steger Building
28 East Jackson Boulevard
Chicago, Ill., U. S. A



NORTHWEST

the STANDARD by which SHOVELS AND CRANES are MEASURED

DON'T LET THE WEED PATCHES SPREAD!

Kill THEM WITH ATLACIDE CALCIUM CHLORATE AND THE KNAPSACK DUSTER

RAPID OPERATION IN KILLING WEEDS

One hundred square feet of area can be covered in 40 seconds. When filled it is ready to use immediately by the operation of the bellows handle. The discharge of dust stops immediately when the lever stops. Therefore, the operation may be intermittent for spotty treatment or continuous on completely infested areas.

Write For Further Information

Chipman Chemical Engineering Co. Inc.
BOUND BROOK, N. J.
Chicago, Ill. Palo Alto, Cal. Houston, Tex. Atlanta, Ga. Kansas City, Mo. Winnipeg, Man.

Western 30-yard drop door air dump cars making a fill at Cincinnati, in Union Passenger Terminal work.

Western Drop Door Dump Cars Are Ideal For Yard Construction

In building the Cincinnati Union Terminal, 122 Western 30-yard drop door dump cars are moving the enormous yardage required for this project. They handle rock, gravel and clay with equal facility. The illustration shows how easily and completely the load is discharged when dumping sticky material. Further, more than a million cubic yards of gravel must be hauled 17 miles over mainline track without interfering with traffic.

Their superior design, construction and operating characteristics make these cars absolutely dependable and give complete safety in high speed mainline operation. Everyone concerned with the economical handling of material in large quantities should have full information on these labor-saving cars. Your request for descriptive catalog No. 81-A involves no obligation on your part. When writing ask for prices and specifications.

WESTERN WHEELED SCRAPER COMPANY
Aurora, Illinois, U. S. A.

WESTERN

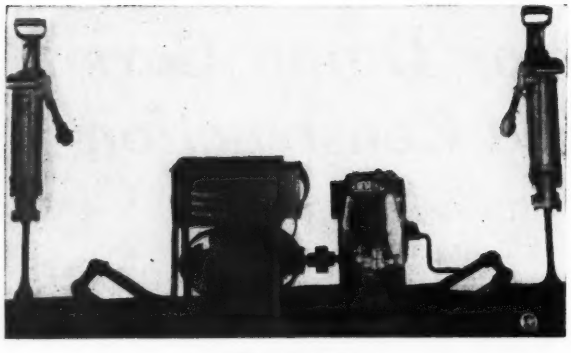
ELECTRICITY IS THE MODERN POWER

SYNTRON

2-TOOL

TIE TAMPING OUTFITS

FOR SPOT SURFACING



2-TOOL OUTFIT

Small and Light Portable Gas-Electric Power Plants. (Weight 300 lbs.)

* * *

Mounted on sled like frame. Easily dragged along the track by one man.

* * *

Will also operate nutter, screw spike-driver, rail drill, tie borer, grinder, etc.

MAGNET HAMMER TAMPERS

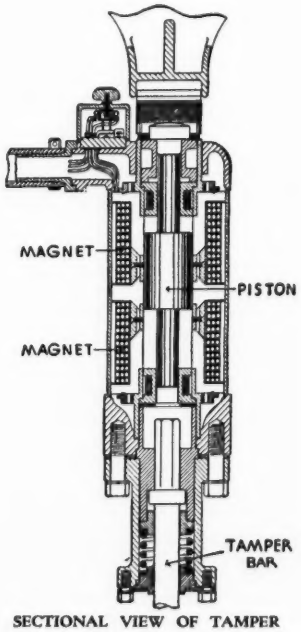
WITH

Only One Moving Part

That Are Simple in Design, Easy to Maintain, and That Always Strike A

UNIFORM BLOW

Also Built in 4-6-8-12-16 Tool Outfits



SECTIONAL VIEW OF TAMPER

SYNTRON COMPANY

Pittsburgh, Penna.

15 Factory Service Branches

20 CLASS I RAILROADS USE IT

A letter will bring you the complete story of the Morrison Metalweld Process for reconditioning manganese track units

WRITE NOW!

Morrison Metalweld Patents Pending

MORRISON RAILWAY SUPPLY CORP.

Buffalo, New York
25 East Huron Street

Chicago, Illinois
59 E. Van Buren St.

Writing *their* Records *in the* Ground

More than twenty years' service has established the remarkable durability of GOHI CORRUGATED CULVERTS. The reason why they last longer is: the GOHI Genuine Open Hearth Iron — guaranteed 99.90% pure iron-copper alloy — from which they are fabricated.

Judge a Culvert by its Record *in the Ground*

GOHI Culverts have been demonstrating their durability and practical advantages for railway drainage for almost a quarter of a century.

Many GOHI Culverts, installed in 1909, were examined during the past year. In every instance, they were found to be practically perfect, notwithstanding the more than twenty years of warfare against the forces of soil, water, erosion, corrosion, freezing, and the vibration of heavy trains.

GOHI Culverts stand up under the most adverse conditions. In new fills which are settling or shifting, the natural flexibility of these culverts prevents them from being broken, crushed or pulled apart, as too frequently happens with rigid types.

It is such performance — in the ground — that justifies the installation of GOHI Culverts wherever low-cost-per-year drainage is desired. Write today to nearest GOHI Fabricator for full information.

GOHI CULVERT MANUFACTURERS, Inc.
Newport, Kentucky

GOHI FABRICATORS

The Newport Culvert Co.
Newport, Ky.

The Pennsylvania Culvert Co.
Philadelphia, Pa.

Denver Steel & Iron Works Co.
Denver, Colo.

A. N. Eaton, Metal Products
Omaha, Nebr.

Feenaughty Machinery Co.
Portland, Oregon

Tennison Brothers
Texarkana, Ark.

Capital City Culvert Co.
Madison, Wis.

Central Culvert Co.
Ottumwa, Iowa

Roanoke Sales Corp.
Roanoke, Va.

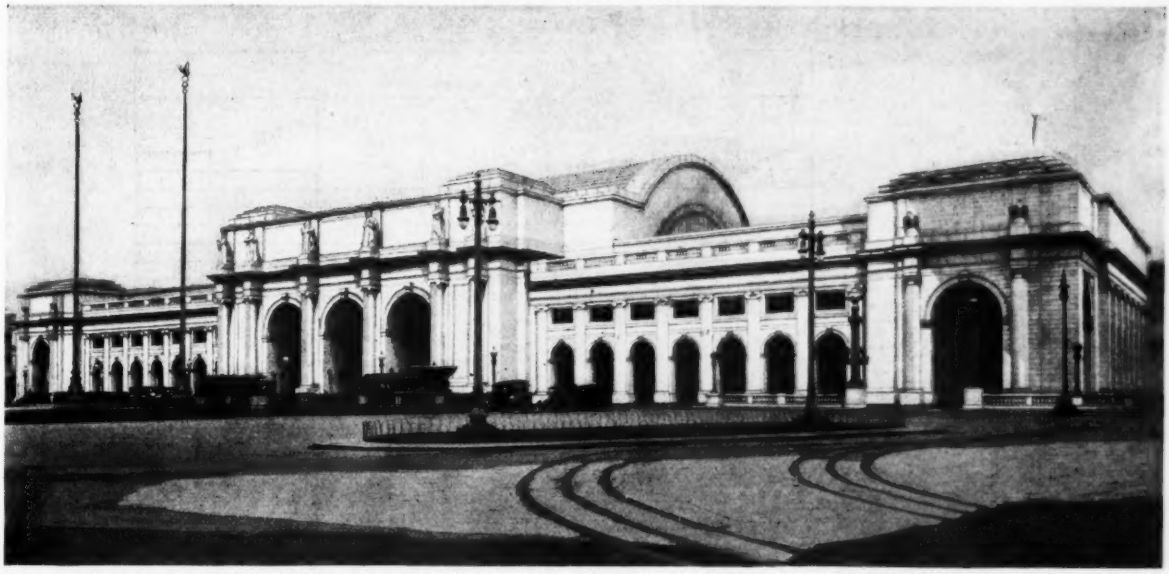
St. Paul Corrugating Co.
St. Paul, Minn.

Tennison Brothers
Oklahoma City, Okla.

GENUINE OPEN HEARTH IRON
GOHI
TRADE MARK
PURE IRON - COPPER ALLOY
REG. U.S. PAT. OFF.

(Meet copper-bearing pure iron requirements in all accepted specifications for corrugated metal culverts).

GOHI
PRONOUNCED "GO-HIGH"
Corrugated
CULVERTS



Washington Union Passenger Station — Architects: Messrs. D. H. Burnham & Co. General Contractors: Thompson-Starrett & Co., New York. Medusa Waterproofing used.

SHOULD RAILROAD CONCRETE WORK *BE WATERPROOFED?*

Medusa Waterproofed Portland Cements, white and gray, "*successful for twenty-one years,*" have been consistently used by leading engineers, architects and contractors to meet the most severe water conditions. Because concrete and mortar is usually exposed to water and moisture, ground acids and acid fumes in the air, the freezing and thawing action and changes of temperature, it should be waterproofed. ♦ Medusa Waterproofed Portland Cements are prepared by grinding Medusa waterproofing in Medusa Portland cement at the mill. This means that the waterproofing is uniformly distributed throughout the entire mass of concrete. It means less supervision and less materials to handle on the job, also the elimination of the human element hazard always present when waterproofing materials are added on the job. ♦ Railroad concrete exposed to all kinds of conditions should be waterproofed and your specifications should read "Medusa Waterproofed Portland Cements." Send the coupon below for the book entitled "How to Make Good Waterproofed Concrete."

Use Medusa Portland Cement Paint for painting concrete and masonry surfaces, exterior or interior. It is the only paint that becomes a homogeneous part of the surface.

MEDUSA PORTLAND CEMENT CO., 1002 Engineers Bldg., Cleveland, O.

Manufacturer of Medusa Gray Portland Cement (Plain and Waterproofed); Medusa Waterproofing (Powder or Paste); Medusa White Portland Cement (Plain and Waterproofed); Medusa Portland Cement Paint and Medusa-Mix, the Masonry Cement.

MEDUSA
WATERPROOFED PORTLAND CEMENTS
(WHITE AND GRAY)

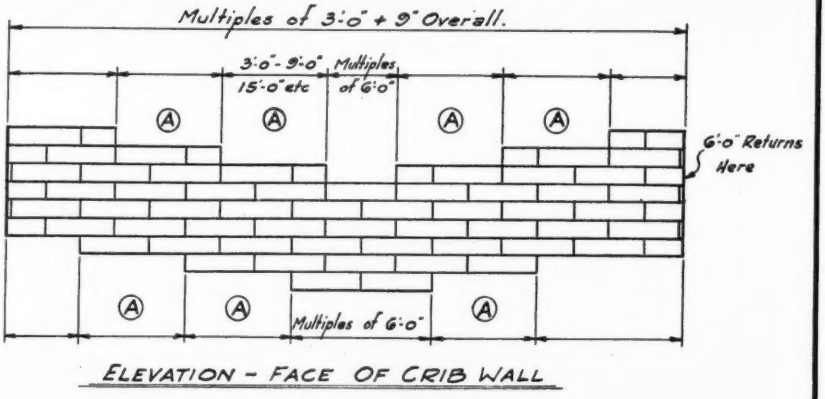
MEDUSA PORTLAND CEMENT COMPANY, 1002 Engineers Building, Department O, Cleveland, Ohio
Gentlemen: Without obligation please send me a copy of the book "How to Make Good Waterproofed Concrete."

Name of Railroad .....

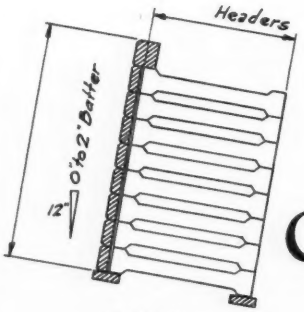
Attention of .....

Address .....

City ..... **State** .....

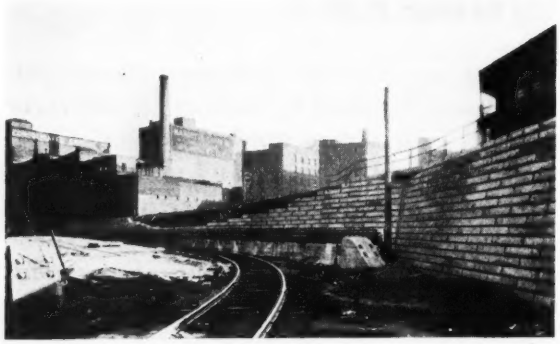


ELEVATION - FACE OF CRIB WALL



TYPICAL CROSS SECTION

Compare this Retaining Wall —*on the Drafting Board* —*out on the Road*



Federal Retaining Wall erected by the Pennsylvania Railroad at Pittsburgh. Note the splendid closed-face appearance of this wall.

When you lay out your walls for Spring construction a strict comparison of the designs available will show 2-Piece Cribbing to be more economical than poured concrete because there are no forms, no stripping or rubbing, no expensive foundations,

—more economical than other cribbing systems because there are only *two* units to handle—and because the *closed-face eliminates all maintenance.*

Federal has other advantages—great stability, fine masonry-like appearance, 100% salvage if the wall is moved. You can check all of these points *out on the road*—on Federal walls erected by the country's most prominent lines over a period of years. Booklet on request.

FEDERAL-AMERICAN CEMENT TILE CO.

Executive Offices: **608 South Dearborn Street - - - - - Chicago**

Plants Near **CHICAGO - NEW YORK - PITTSBURGH - BIRMINGHAM**

Concrete Products *for Over 25 Years*

FEDERAL 2 piece Concrete CRIBBING

TIMKEN BEARING EQUIPPED

"Sheffield No. 46"

solves the One-Man Car problem

Railway men have been quick to see that the recently announced "Sheffield No. 46" fills a real need. This car is easy to handle and is decidedly economical to operate. It weighs less than 400 pounds and the lifting weight with handles extended is only 100 pounds.

The "Sheffield No. 46" is exceptionally strong and rugged. Its remarkable light weight has been secured through the liberal use of heat treated aluminum alloys—as strong as steel with only one-third the weight. The powerful single-cylinder engine can be depended upon in every kind of weather and the clutch can't be burned out. True "Sheffield" quality standards are maintained throughout.

First on the rails —and still first

While the "Sheffield No. 46" is designed as a one-man car, it will accommodate two men very comfortably. Ample room for equipment is provided as a glance at the illustration will indicate. You'll be interested in complete specifications. We will send them promptly on request.

FAIRBANKS, MORSE & CO.
900 S. Wabash Ave., Chicago
32 branches at your service throughout the United States

FAIRBANKS-MORSE
MOTOR CARS

Compare the "Sheffield 44B" with other cars!

Men who have had experience with the "Sheffield 44B" will tell you that this is the best single-cylinder section car on the rails. They know how the "Sheffield" stands up under hard service. They know that this car can't be matched on low maintenance and long life.

The "Sheffield 44B" is *built* to deliver superior performance. It is strong enough to take hard knocks without a whimper. Yet strength is not secured at the sacrifice of fuel and oil economy. Here is a car that is a stranger to the repair shop. The clutch can't be burned out and both the engine and drive can be depended upon winter and summer in all kinds of weather.

Compare the "Sheffield 44B" with other cars. That is the surest way to determine its obvious superiority.

FAIRBANKS, MORSE & CO., Chicago

Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; stationary and marine oil engines; steam, power and centrifugal pumps; scales; motors and generators; complete coaling stations.

TIMKEN BEARING EQUIPPED

FAIRBANKS-MORSE
MOTOR CARS

RA21.77

Now LIFETIME SECURITY

AGAINST TROUBLESOME STREAMS

Three things are accomplished by enclosing troublesome streams with ARMCO Paved Invert Pipe:

1. Erosion of culvert invert is successfully combated.
2. The service life of the structure is materially lengthened.
3. Safety is assured at lower cost per year.

BASICALLY, ARMCO Paved Invert Pipe is Armco Corrugated Pure Iron Pipe which has an unequaled record to date of 25 years' service under the railroads and highways of the United States and Canada.

To successfully combat erosion, the invert of ARMCO Paved Invert Pipe is paved with a tough, resilient, bituminous material which effectively resists the wear of hydraulic traffic—silt, sand, gravel and even boulders.

Now after six years of service tests in "Nature's Laboratory," ARMCO Paved Invert Pipe proves its ability to outlast unprotected drainage structure.

Latest engineering data, explaining in detail laboratory and field tests of ARMCO Paved Invert Pipe, is now available on request.

ARMCO Paved Invert PIPE

Armco culverts and drains are manufactured from ARMCO Ingot Iron of the American Rolling Mill Company and always bear its brand.

ARMCO CULVERT MANUFACTURERS ASSOCIATION *Middletown, Ohio*

Ingersoll-Rand

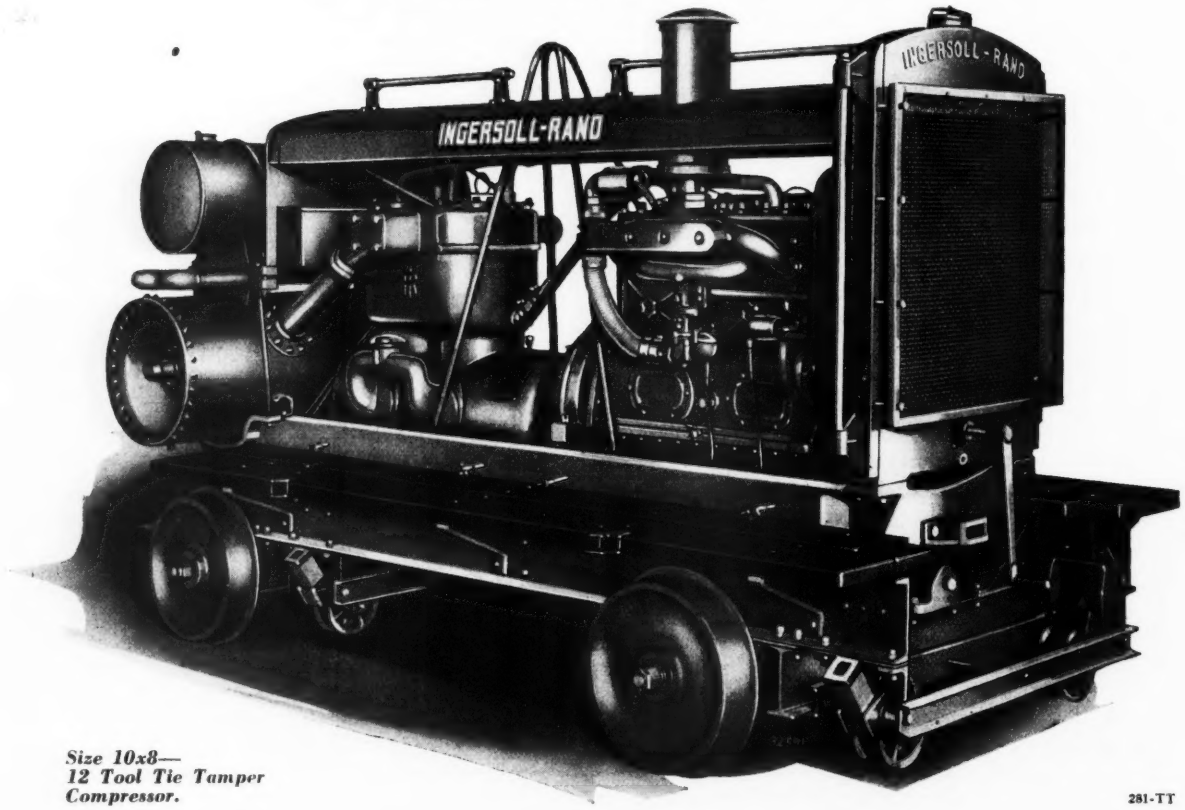
Pneumatic Tie Tampers
and
Air Compressors

In 1913, an Ingersoll-Rand Pneumatic Tie Tamping Outfit was first successfully put into commercial use. The road which used this original machine now employs over 400 complete outfits.

By reason of long experience in railroad work, Ingersoll-Rand is in a position to offer a very advanced line of equipment and to render a superior grade of service. This service applies not only to the installation of equipment, but to the organization of gangs for the proper handling and maintenance of the tools.

INGERSOLL-RAND COMPANY - 11 Broadway - New York City

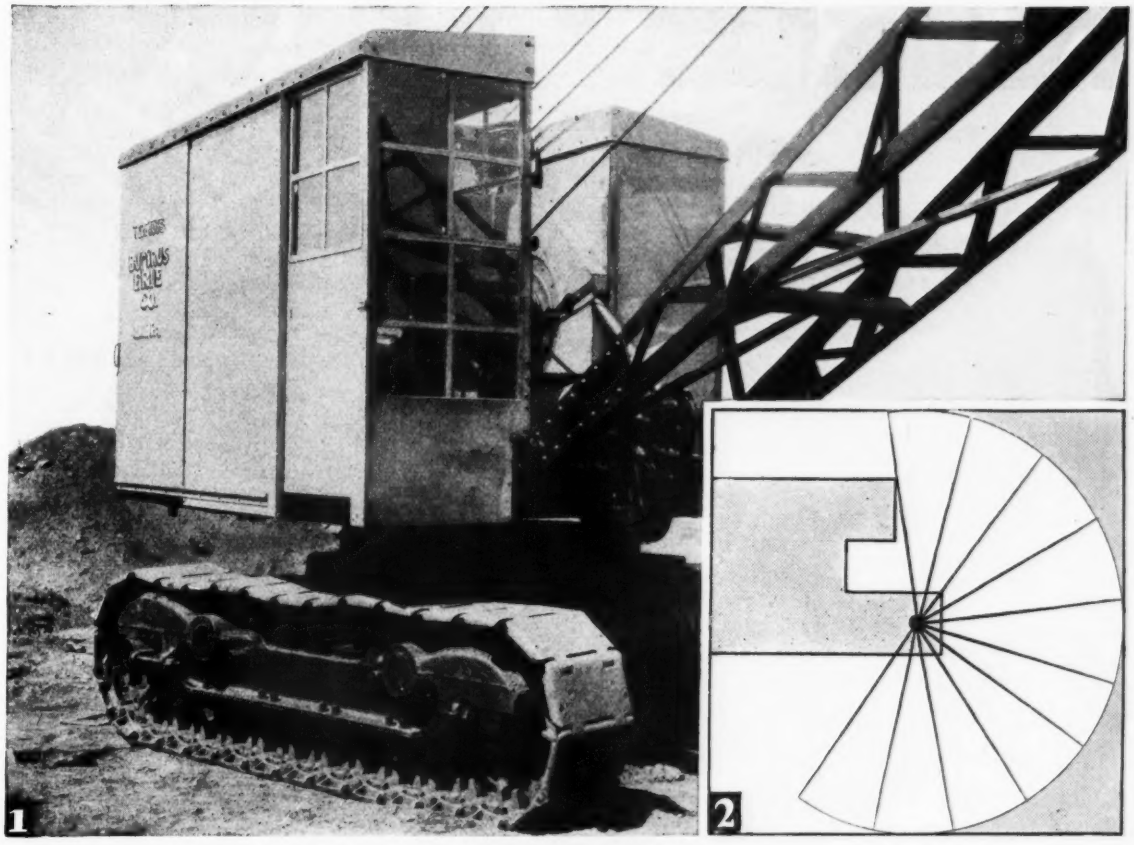
Branches or distributors in principal cities the world over.



Size 10x8—
12 Tool Tie Tamper
Compressor.

281-TT

. . . Vision



These illustrations show what a complete view the operator has of his work. He sees, not just the boom and bucket, but the whole job.

You'll get faster operation on Bucyrus-Eries in any weather—full visibility ensured by the carefully arranged windows of this steel house.

Standard equipment on $\frac{1}{2}$ to $2\frac{1}{4}$-yard gasoline, Diesel, electric, and Gas+Air machines. Write for bulletin!

A-252

BUCYRUS ERIE

BUCYRUS-ERIE COMPANY, South Milwaukee, Wisconsin

Representatives throughout the U. S. A. *Branch Offices:* Boston, New York, Philadelphia, Atlanta, Birmingham, Pittsburgh, Buffalo, Detroit, Chicago, St. Louis, Kansas City, Mo., Dallas, San Francisco. Offices or distributors in all principal countries.

KREOLITE

SOLID UPLAND MOUNTAIN OAK
R. R. CROSS AND SWITCH TIES

The favorable location of our several Plants enables us to purchase solid Upland Mountain Oak to advantage.

The life of treated timber depends upon the character of the preservative used. **We distill our own Creosote Oil.** By so doing it is possible for us to insure to the purchaser a uniform pure product of any grade desired.

Enormous stocks of Cross Ties, Switch Ties, Structural Timbers and Piling, in all sizes, in Solid Oak or Pine, properly sticked and air seasoned before treatment, available for prompt shipment from Toledo, Ohio, or our Midland Creosoting Company plant, Granite City, Ill. (East St. Louis).

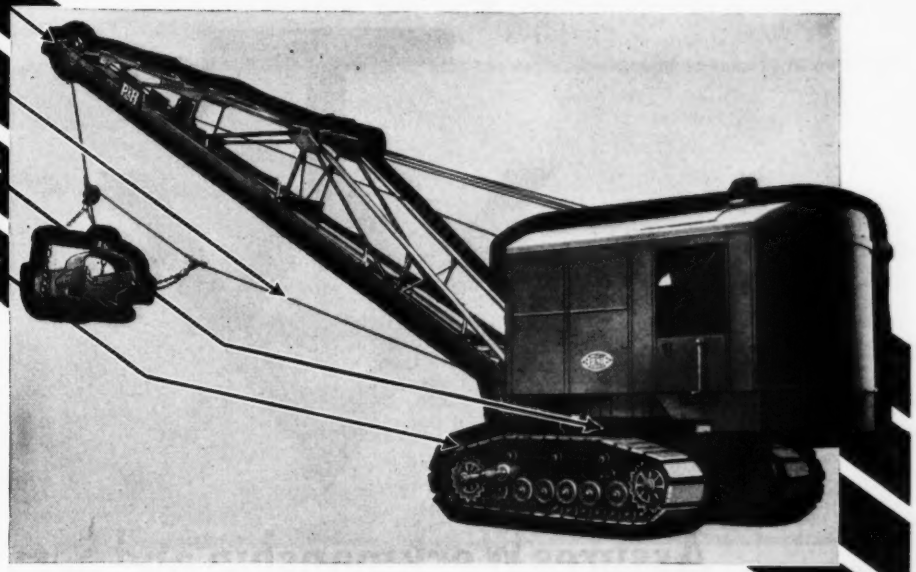
THE JENNISON-WRIGHT COMPANY, TOLEDO, OHIO

Branches in All Large Cities

R. R. TIES

It takes the whole machine to determine capacity

Faster Hoist Speeds
Faster Drag Speeds
Faster Swing Speeds
Faster Travel Speeds



Size of bucket, alone, can never determine the amount of dirt you can move per dollar. Capacity depends, also, upon:

1. **The rapidity with which a machine can move its bucket—in digging, in swinging, in emptying.**
2. **The speed at which the machine can be moved to its job, and can be kept at the digging face with the minimum of lost time for laborious maneuvering and slow travel speeds.**
3. **The proportion of time the machine can be kept on the job without frequent and costly breakdowns.**

These are the three factors by which you can safely judge a P & H Excavator. P&H assures you faster swing speeds, faster hoist speeds, faster drag speeds, two speed tractions, more powerful motors, and the greatest attainable strength in every part, more economical operation under the most rigorous conditions of railroad usage.

HARNISCHFEGER CORPORATION
Established in 1884
4420 W. National Ave. Milwaukee, Wisconsin

Offices and Agents in All Principal Cities

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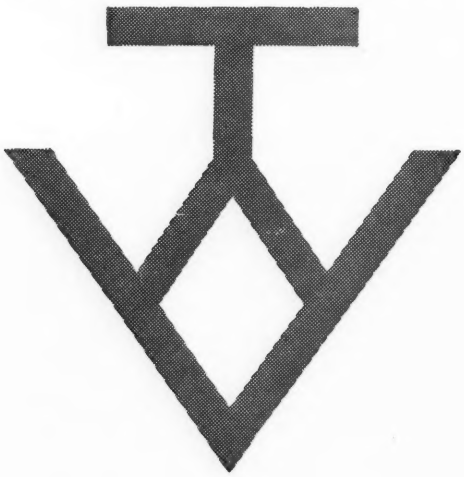
27 STANDARD MODELS

$3,500.00 TO $65,000.00

SHOVELS — DRAGLINES — CRANES
SKIMMER SCOOPS — TRENCH HOES

FULL REVOLVING MODELS 3/8 TO 3½ CUBIC YARDS CAPACITY

THIS TRADE MARK ON A TOOL



Assures Workmanship and Service

The master workmen at Verona plant are born—not made. Their fathers held their jobs before them. These fathers in turn inherited their ability from the grandsires of the present generation.

Tradition of their craft—pride in their inheritance—pride in their products—pride in their guild—keep these master craftsmen producing articles of the finest workmanship.

Their ability to keep up with the use of the most modern scientific devices guarantee tools of the finest quality.

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1800 First National Bank Building
PITTSBURGH, PA.

Established 1873

The First Gas-Electric Wrecking Crane For The Nation's Railroads

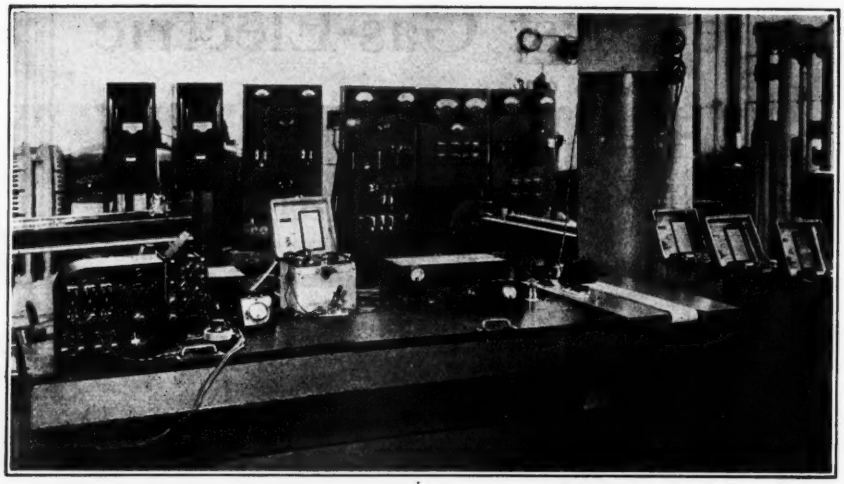
COOPERATING with a well known railroad, Industrial Brownhoist built its first locomotive crane a half century ago. During the intervening years over two thousand wrecking, locomotive and crawler cranes have been sold to the railroads. Now the design and building of this first gas-electric wrecking crane, the largest railroad crane ever built, has been entrusted to us.

This new Industrial Brownhoist has a capacity of 105 tons at each end and is equipped with three independent power units consisting of one 208 cell storage battery and two 225 H. P. gas engines direct connected to generators. All movements are electrically operated and the machine travels over 30 miles per hour.

The first of these cranes has been built for the Cleveland Union Terminals Co., and a second is under construction for the New York Central Railroad for use on their west side electrification project in New York.

Industrial Brownhoist Corporation, General Offices, Cleveland, Ohio
District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, San Francisco, New Orleans
Plants; Brownhoist Division, Cleveland, Ohio: Industrial Division, Bay City, Michigan:
Elyria Foundry Division, Elyria, Ohio.

INDUSTRIAL BROWNHOIST

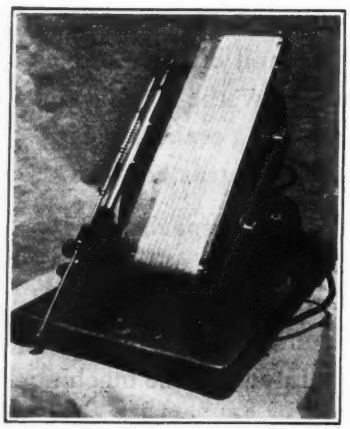


General view in one of the Sperry Rail Service laboratories, showing complete Detector Car equipment set up for experimental work and periodical testing and calibration of equipment sent in from cars.

CENTRAL CONTROL

INSURES MAXIMUM EFFICIENCY OF SPERRY RAIL TESTS

The central control and supervision of SPERRY RAIL SERVICE maintains uniform high standards of rail test "insurance."



Inspection machine used by expert operators in analysis of record tapes sent in daily from cars.

MATERIAL TESTING. All materials, supplies and electrical units used in routine operation are tested by the central laboratory.

CALIBRATION OF EQUIPMENT. A constant check on the accuracy of Detector Car equipment is maintained by frequent calibration of the test equipment in the central laboratory.

EXPERT INTERPRETATION of Detector Car records is provided by trained inspectors in the central office before delivery of record tape to railroad. This permits immediate check on each car's operation.

RAIL TESTING STATISTICS are compiled by the central office from daily operating results on many different railroads, giving all users the benefit of this collective rail test experience.

These services, which are essential to an adequate rail test program, can only be offered by a centralized service organization, operating a fleet of Detector Cars, and providing all the central facilities for technical supervision which have been necessary to build up the high efficiency of the SPERRY RAIL SERVICE.

SPERRY

SPERRY RAIL SERVICE

SPERRY PRODUCTS, INC.

Sperry Building, Manhattan Bridge Plaza, Brooklyn, N. Y.

Chicago Office: 80 East Jackson Blvd.

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THE NORDBERG POWER JACK

Rush Jobs — Raise Track Standards

Doubled or tripled speed, yet a good track raiser gets more accurate surface and alignment than before!

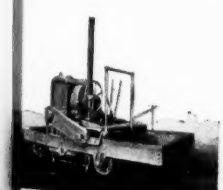
Nordberg Power Jacks are giving A-Raise-A-Minute and A-Mile-or-More-of-Track-A-Day performance everywhere they are in use. They raise the track with hair's breadth accuracy, and prevent excessive settling by "easing off" the load. And they can't kick out, slide, or tilt, thus eliminating re-aligning expense.

Speed up your scheduled ballasting operations—improve track standards — and make big savings — by putting Nordberg Power Jacks on the job.

Another New Machine
SEE FOLLOWING PAGE...

NORDBERG MFG. CO.
Milwaukee, Wis.

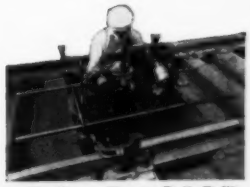
NORDBERG



dberg Track Shifter

Nordberg Adzing Machine

Nordberg Power Spike Puller



Nordberg Power Rail Drill

The New NORDBERG CROSS GRINDER

First on one rail——

——then on the other

At switch points

In case of emergency.

For Beveling to Counter-Act End-Flow

To Prevent Chipped and Battered Rail Ends

The development of the Nordberg Cross-Grinder brings to track maintenance operations a machine that meets fully the need for a fast, effective, self-contained, power operated means of cross-grinding and beveling rail ends.

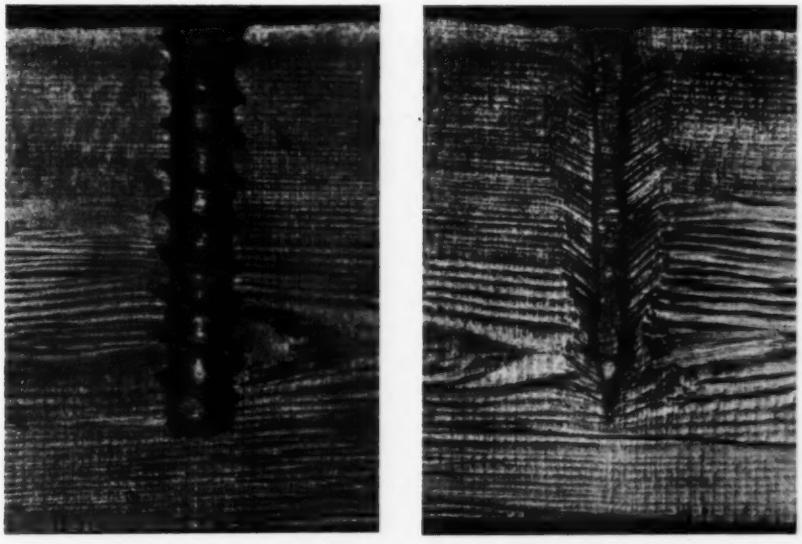
One operator bevels 30 to 40 joints an hour, and he can easily move the machine. At switches, both switch points can be reached from one position. The machine moves freely on double flanged wheels —observe how easily it is handled, and how flexible it is in use.

Any thickness of grinding wheel from 1/8" to 1" can be used, to grind switch points, or for any other portable grinding work. Or a wire brush may be used for cleaning steel. Full particulars on this machine on request.

NORDBERG MFG. CO.

Milwaukee, Wis.

Why Ties Last Longer with



An ordinary spike was driven into a standard wood tie, a Bethlehem Tie Plate Screw Spike screwed into the same tie, and the above sections made. Notice that while the ordinary spike left the wood fibers badly crushed and broken, the screw spike did not damage them.

TIE PLATE SCREW SPIKES

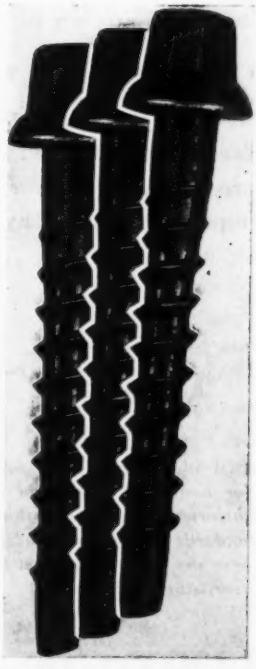
The right-hand illustration at the top of the page shows what happens to the tie when an ordinary spike is driven. With the wood fibers that surround the spike crushed and broken, the spike soon loosens under traffic, allowing the rail considerable play which of course tends to loosen the spikes still more.

●

Ties last longer with Bethlehem Tie Plate Screw Spikes, principally because these spikes are inserted in the tie without any damage to the wood fibers. The screw spike, screwed into a previously bored hole, compresses the fibers but does not injure them. The screw spike has great holding power because the thread provides large surface contact between tie and spike, and this holding power is retained because the wood fibers are left intact and strong.

●

Further, because the spike remains tightly in the tie there is no chance for water to seep in around the spike and cause gradual decomposition of the wood.



●

Another reason for longer tie life is the great lateral stiffness of Bethlehem Tie Plate Screw Spikes. Movement of the tie plate against the tie is virtually eliminated, relieving the tie of much destructive wear and tear.

●

That ties do last longer where Bethlehem Tie Plate Screw Spikes are used is indicated by the careful checking of results obtained in numerous installations. Records of one railroad that is a large user of these Screw Spikes indicate that their tie renewals have been reduced by approximately one half.

●

BETHLEHEM STEEL COMPANY, *General Offices:* Bethlehem, Pa.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Cincinnati, Detroit, Chicago, St. Louis

Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Los Angeles, Seattle Portland, Honolulu

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BETHLEHEM

One Man in Forty— *and YOU are the Man*

DID you ever stop to think that *you* are one of the comparatively small percentage of men whose "yes" or "no" really matters to American business?

Every morning 40,000,000 men start to work—in factories and mines, banks, railways, stores and other centers of industry or trade. Forty million men turn the wheels that keep America clothed, sheltered and fed.

But only one million of them make business decisions. Only one man in forty has the ability, the responsibility or the authority to say yes or no in business matters. Hence the *real* managing power of the country lies in the hands of these million men—less than one per cent of its total population.

As a member of this group—this controlling minority—you share an important responsibility—the triple responsibility of wisely liberal purchasing, of generous employment and of sane management to hasten the return of general prosperity.

• • •

How, you ask, do we know that *you* are one of the million who make decisions for others to follow? Because men who read business papers are alert and eager for news of new plans, new methods, new equipment. That is *why* they are men who control affairs.

THIS SYMBOL *identifies an ABP paper . . . It stands for honest, known, paid circulation; straightforward business methods, and editorial standards that insure reader interest . . . These are the factors that make a valuable advertising medium.*

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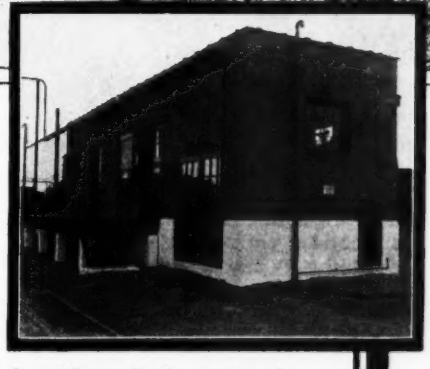

Oxweld standard generator house containing rooms for acetylene generator, oxygen manifold and carbide storage.

OXWELD RAILROAD SERVICE

RESPONSIBILITY

THE function of Oxweld Railroad Service is to insure the efficient and most advantageous application of oxwelding and cutting to the needs of the railroads it serves.

Railroads employing this service are provided with the best facilities that can be had. With no capital investment on the part of the railroad, Oxweld Railroad Service furnishes thoroughly modern and adequate facilities designed and constructed by engineers qualified by years of railroad experience. This includes generator houses, acetylene generating equipment, oxygen manifolding and storage facilities, oxwelded leak-proof distribution systems and welding and cutting apparatus. Employees of the railroad are trained in welding technique by Oxweld Railroad Service supervisors, who are also available for advice and consultation on all oxwelding and cutting operations.

Acceptance of these responsibilities has made Oxweld Railroad Service indispensable to a majority of the Class I Railroads of the country. It is one of the reasons why they contract for this service year after year.

THE OXWELD RAILROAD SERVICE COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

NEW YORK
Carbide and Carbon Bldg.

CHICAGO
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No. 28 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING COMPANY

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: In the Mail

March 26, 1931

Dear Reader:

Within the last few days, we have received the following letters:

From a chief engineer:

> It is my intention to urge each of our assistant engineers and supervisors to subscribe to Railway Engineering and Maintenance in order that they may keep in close touch with the latest methods and practices for railway maintenance. Kindly send me 50 application blanks.

From a roadmaster:

> Your February issue was so unusually interesting that after reading it, the thought occurred to me that any foreman who would subscribe to this magazine could not help being materially aided in his work since it deals with those phases of track work which constitute his everyday life. I will, therefore, appreciate your sending me 233 copies of this issue in order that I may give one to each of my foremen to enable them to decide whether they would not like to subscribe for it.

From a chief clerk to an engineer maintenance of way:

> One of our section foremen has just written us as follows: "I think that every foreman on the . . . . . railroad should study the editorial starting on page 121 of the February issue of Railway Engineering and Maintenance. If we foremen should carry the message in this editorial to our men, we would be doing something worthwhile." This is the fourth letter that we have received from foremen calling this editorial to our attention.

From a yard foreman:

> I have been a reader of Railway Engineering and Maintenance for 19 years. I owe a great deal of my success as a trackman to information gleaned from its pages.

Letters such as these, which we are receiving in increasing numbers of late, cause us to feel that our efforts to promote more efficient maintenance practices are meeting with a gratifying degree of approval from you who are on the firing line.

Yours truly,

Elmer T. Howson

ETH*JC

Editor.

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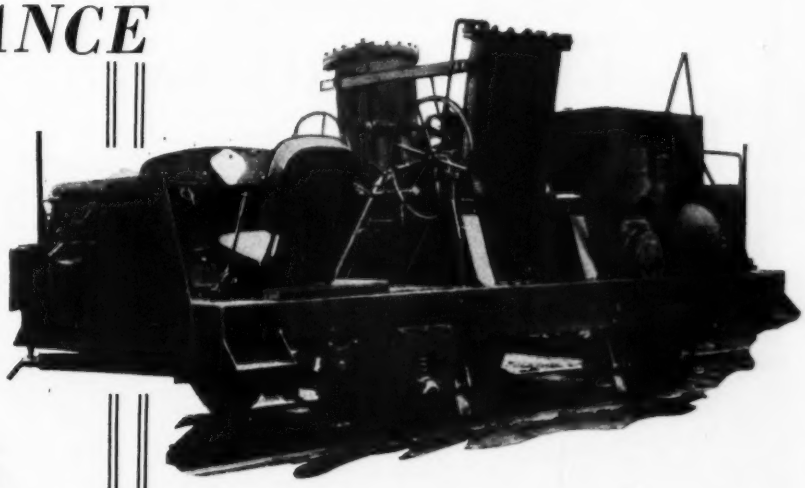
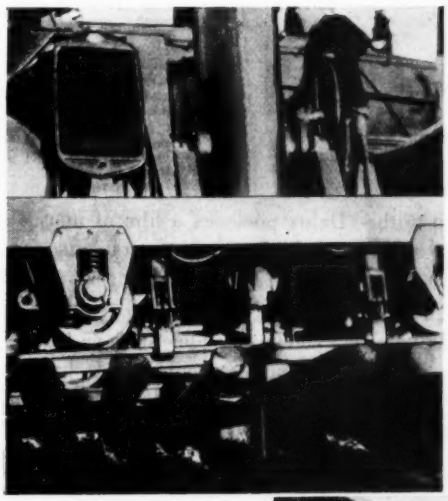
CUT MAINTENANCE COSTS

with

THE BUTLER AIRWAY



TRACK MASTER



This all duty maintenance machine offers the simplest, most efficient and economical solution to the problem of maintenance cost reduction.

Combined in the BUTLER AIRWAY TRACKMASTER you have an air compressor . . . track jack . . . gang car and light switching engine.

This machine will more than double the track ballasting mileage of any crew. Maximum track shifting and lifting are greatly simplified and speeded up. And the machine requires only one operator.

In successful operation over two years.

Full details concerning its application to your various maintenance jobs will be gladly furnished.

BALDWIN-SOUTHWARK CORPORATION
Southwark Foundry & Machine Co. Div.
PHILADELPHIA

SOUTHWARK

THIS CAR has a message for Every Railroad...

For many extra miles this car will be safe from corrosion, and the longer lasting color and gloss of Dulux will keep its good appearance.

DUPLEX VEHICLE
19 months' exposure

BEST METAL PROTECTIVE VEHICLE
7 months' exposure

Single coats exposed on 45° panels facing south, without pigments. Experience proves such exposure about three times as severe as normal vertical exposure of film pigment. Dulux shows 175% greater durabilty.

It's a story about du Pont DULUX

THE picture shows how one railroad is going to make its rolling stock earn more revenue. It is evidence of a railroad's desire to reduce operating costs and costs of maintaining its equipment.

This car is finished with du Pont Dulux, the most recent chemical development of the du Pont laboratories, which is already setting up new standards for finishes on wood or metal. It is protected with a finish which tests indicate has from 50% to 100% greater durability than highest type metal protective paints. Three-year field tests are authority for this fact.

The Dulux finish on this car will preserve its original appearance from 50% to 100% longer than highest type metal protective paints. Three-year field tests have indicated this, too.

These two important advantages Dulux brings to every piece of metal equipment and to metal structures owned by a railroad. Because, you see, du Pont chemists built into Dulux finishes unusual resistance to checking, cracking, and peeling, which in ordinary finishes expose the covered metal and allow rapid corrosion.

In addition to this, Dulux possesses a film of unusual hardness, which adheres tightly . . . resists scratching and prevents penetration of moisture, corrosive gases, oils, and salt air.

We should like to give you the complete story on Dulux. Yes, there is a lot more. And we should like to have a Service Engineer discuss with you how and where you can best use it now. Just send your request for further information to E. I. du Pont de Nemours & Co., Inc., Dept. S4, 1616 Walnut Street, Philadelphia, Pa.; 2100 Elston Ave., Chicago; 351 California St., San Francisco.

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DULUX

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Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

APRIL, 1931

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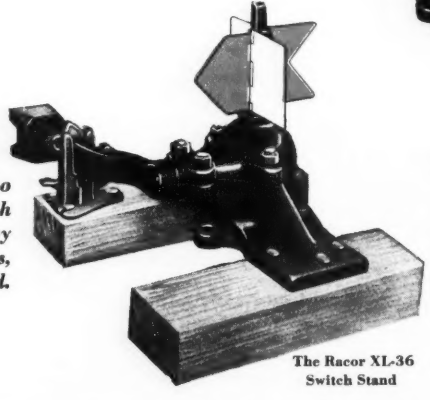
IT'S SO SIMPLE

This is the handle and shaft of the Racor XL-36 Switch Stand . . .

The lower bearing of the shaft is inserted in a roller. Fastened to the shaft by a cotter pin, the roller slides into the slot of the spindle. These members, of extra large wearing surfaces, are the only working parts and, set in the base, make this very simple yet highly efficient mechanism. The extreme simplicity of it is evidenced in the picture. Adding the cover completes the stand.



The Racor XL-36 Switch Stand

LOST motion and trouble from wear so prevalent in ordinary low, rigid switch stands are eliminated. Designed for heavy service in yards and on main lines, where rigid switch stands are preferred.

THESE stands are gearless and parallel throw. They have stood the test of time and use . . . Write for free booklet postpaid. It tells of the use and installation of the Racor XL-36 Switch Stand.

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RACOR TRADE MARK

Railway Engineering and Maintenance

WATERWAYS

An Unfair Form of Railway Competition

D. B. Robertson, president of the Brotherhood of Locomotive Firemen and Enginemen and chairman of the Railway Labor Executives Association, emphasized the fact in a recent address that the employee's stake in the success of the railways is two and one-half times that of the investor. He supported this statement by the fact that while $1,000,000,000, if earned, goes annually for dividends, interest and other fixed charges and for surplus, more than $2,500,000,000 goes first to labor. Furthermore, when the railways suffer, labor also suffers through unemployment. Every employee, therefore, has a very direct interest in any form of competition that threatens his future income.

One of the most insidious campaigns that has ever been waged against the railways is that now being promoted by the advocates of inland waterways. Since it is a menace to the future prosperity of the roads, it demands the serious attention of every railway employee. He owes it to himself and those dependent upon him to acquaint himself with the facts regarding inland waterway competition in order that he may be able to refute the misleading and inaccurate statements that are being made with such abandon today.

The present campaign for waterways possesses vast political backing. The national administration is committed to a system of some 27,000 miles, involving the deepening of the Mississippi, the Ohio and the Missouri rivers and their tributaries. Estimates call for the expenditure of some $200,000,000, and, once started, there is little idea where such a system may lead.

Will "Relieve" the Railways?

What are the arguments for the expenditure of this vast sum for the construction of a duplicate and competitive transportation agency? The one that is usually advanced is that the waterways will "relieve" the railways of a vast tonnage of heavy, slow moving traffic and leave them free to devote their attention to that residue of high-class tonnage that pays higher rates. It is true that the waterways, if completed, will relieve the railways of traffic, but it will be traffic that they sorely need. With 650,000 idle freight cars and with 250,000 railway employees out of work because of lack of traffic, the contention that the railways need relief is untenable.

Furthermore, shortages of equipment and congestion induced by lack of other facilities, once characteristic of periods of business activity, have been permanently eliminated by the vast expenditures for improved facilities during the last few years, until today shippers know that they can have all the cars required for loading when they want them, providing only that they give reasonable notice of their need. The railways are not only able to move any traffic that may be offered them, but will move it far more expeditiously than the waterways can ever do.

Will Cheapen Transportation?

Another argument that is advanced is that inland waterways will cheapen transportation. To ascertain the merit of this contention, one must consider not only the published tariffs, but *all* costs, because a large part of the cost of water transportation consists of public subsidies in the form of interest and maintenance costs. These charges, while paid by the public through taxes, rather than by the user of the waterway, are just as much a part of the cost of waterway transportation as the corresponding charges which the railways, of necessity, include in their rates.

To ascertain how these costs compare, the Bureau of Railway Economics has determined the average total cost of transportation per ton between points 100 miles apart to be as follows:

By the New York State Barge canal, $1.94, consisting of freight rates, $0.45 and taxes, $1.49; corresponding rate by rail, $1.09.

By the Ohio River system, $1.24, consisting of freight rates, $.060 and taxes, $0.64; corresponding rate by rail, $0.88.

By the Mississippi river, $1.12, consisting of freight rate, $0.60 and taxes, $0.52; corresponding rate by rail, $1.01.

By quoting only the published rates, the waterway advocates attempt to create the impression that water transportation will effect vast economies for the public. It remains for railway employees to see that the public understands that funds expended for the construction and maintenance of these waterways are an essential element of the cost and must be included, even though in the form of a public subsidy to a favored group of shippers.

This is borne out by the experience of New York with its barge canal. After spending more than $273,000,000 for this waterway, which was designed for a maximum capacity of 20,000,000 tons per annum, there has been only one year since its completion in 1918 that it has carried more than 3,000,000 tons. As a result, the present total cost of transportation on the canal is nearly 80 per cent *higher* than the average rate on the railways operating alongside.

Equally unsatisfactory are the results shown by the government-owned barge line on the Mississippi river.

From the organization of the Inland Waterways Corporation to December 31, 1929, it has earned a deficit of nearly $500,000, in spite of the fact that it has paid neither taxes nor interest on the investment. Similarly, in a petition filed with the Interstate Commerce Commission within the last few weeks, a privately-owned barge line operating on the Mississippi river stated that it was operating at a loss of $40,000 per month, and added that, without action by the commission in forcing through rates with the railways it faced disaster.

Will Help Middle West?

Another argument that is advanced, especially in the middle west, is that the construction of the Panama Canal has reacted to the disadvantage of the Mississippi valley and that a system of inland waterways in this territory is required to restore equality in this area. It is true that following the completion of the Panama Canal, the ocean carriers made all-water rates between Atlantic and Pacific Coast points that were considerably lower than the all-rail rates from the Mississippi valley to the western ports. However, the remedy for this condition does not lie in the construction of further waterways, but in favorable action by the Interstate Commerce Commission on the applications of the roads to reduce their rates to competitive coast points without the necessity of readjusting their rate structure correspondingly to intermediate points, which action the commission has steadfastly refused to authorize.

From the standpoint of service, still other comparisons may be drawn. The Erie canal, for instance, is normally icebound for five months of the year, while the railways paralleling it are handling traffic every day, summer and winter. Again, the federal-operated barge line has been forced to cancel many of its sailings on the Mississippi river during each of the last two seasons because of low water, a chronic condition, while operations north of Cairo, Ill., are normally suspended during the winter, forcing the railways in each instance to go to the rescue of the shippers at a time when traffic is being moved in the greatest volume and with the maximum handicaps.

In Brief

In brief, the arguments of the waterway advocates may be answered as follows:

1. There is no present or prospective necessity for inland waterways as a transportation agency. The railways are able and ready to provide any service required.

2. There is no basis for the contention that transportation by inland waterways, as proposed, is cheaper than by rail when *all* costs are considered. Any other basis of comparison is fallacious and misleading.

3. Waterways are unnecessary to the placing of the middle west on a competitive parity with west coast points, for the Interstate Commerce Commission has the authority to permit the roads to so adjust their rates as to provide this parity.

4. The railways provide reliable transportation every day in the year. The waterways do not, being subject to interruptions by ice in the winter and by the vagaries of low water in the summer.

5. Waterway transportation is available to industries only when they deliver their traffic to the water's edge. Railway transportation penetrates all parts of the country, even to the door of the industries.

The present widespread propaganda of waterways savors of "pork barrel politics," which will be defeated only when the public learns the facts. Railway employees can do much in educating the public by seeing that these facts are made known to their friends and acquaintances.

THEY WORK

Snow Melters a Boon During Recent Storm

Few power appliances offered for use in track maintenance have gained widespread use from the start. Instead, the history of most equipment embraces a period of limited use on a few railways during which the officers of other roads take the position that it is a luxury that can be afforded by only a few "wealthy" properties or that its purchase can be justified only under special conditions. Finally, after a certain amount of "watchful waiting," it is discovered that the device or several counterparts of it are capable of widespread application and the original appliance and others embodying a similar idea are purchased in numbers.

Among the outstanding examples of this attitude is the story of the snow melters. The use of heat to keep switches, frogs and other trackwork clear of snow is not new, but at no time since the first heating device was introduced has there been so general an application of such appliances as during the last two years.

The impetus given to the installation of snow melting devices during 1930, can be ascribed in part to the three paralyzing snow storms that swept over the middle west during the winter of 1929-30, during which it was demonstrated that interlocking plants and complex track layouts that were fully equipped with modern heating equipment could be kept clear for train movements when similar plants in the same territory were virtually paralyzed. However, the real reason is no doubt the gradual overcoming of the skepticism concerning the idea of attempting to "warm up out of doors"—in a word—an awakening to the fact that "it works"—and at a reasonable outlay.

Another significant feature of this development that has no doubt greatly influenced progress in application, is the wide variety of equipment that is now available for such use, embracing fixed, semi-fixed and portable devices, and employing several different kinds of fuel as well as electricity and steam as the source of the heat. The results obtained with several types of devices as set forth in the article appearing on page 354 of this issue, are enough proof of their effectiveness. They kept the track clear for use during a storm of equal severity with those which resulted in a virtual suspension of traffic a year ago.

Clearing tracks of snow and ice is emergency work. Its success cannot be measured in terms of the cost of completing a given task, because failure introduces the losses incurred as a consequence of disrupted train schedules. There is also an element of reduced hazard, for in the absence of modern snow melting equipment, the policing of switches during storms entailed the employ-

ment of many men, a large number of whom are temporary employees unskilled in protecting themselves from accident under the unfavorable conditions prevailing during a storm.

The snow melter is not a panacea for all blizzard-borne ills. It will not, for example, prevent the blocking of yard tracks where the snow has a chance to drift around the wheels of standing cars. However, it does solve the very common and exceedingly serious problem of keeping flangeways clear. And that these devices are now accepted as appliances of proved effectiveness is evidenced by the confidence placed in them. As an example, one road dismissed the section gang in its most important yard in Chicago at its regular quitting time during the height of the recent storm because the service of the gang during the night was deemed unnecessary by reason of the snow-melting equipment installed.

Thus, another class of equipment has passed out of the experimental stage.

PILE BRIDGES

Use of Treated Wood Calls for Modified Design

To adapt the pile trestle to the use of treated timber and provide a ballasted deck, it was necessary to introduce some rather drastic departures from the designs previously employed in open-deck trestles built of untreated wood. As experience with the ballasted structures was accumulated, further modifications were made, with the result that structures of this type built today generally conform to designs that are suited to the purpose.

This does not mean that the open-deck trestle has not been improved, for although it is basically the same structure that it was when the railroads were new, it has been subjected to considerable modification of design. The laborious mortising of piles and caps, which served actually to weaken rather than strengthen the bents, is a thing of the past; corbels under the stringers have disappeared; and the dapping of guard timbers is an obsolescent practice.

That the design of open-deck trestles has not been subjected to greater change is due to the fact that until recently these structures have been built exclusively of untreated wood. For some reason, the railroads resorted to creosoted material at first only where it was deemed advisable to secure the advantages of a ballasted deck. However, now that the economies of creosoted timber in wooden bridges have been demonstrated so effectively, the bridge engineers of several railways have been successful in convincing their managements of the desirability of extending the use of treated wood to trestles where the greater expense for a solid deck could not be justified.

These changes in policy introduced an important question, namely, "Is the old design of open-deck trestle satisfactory where creosoted material is to be used." Ten years ago this question would scarcely have been raised, but with the knowledge that is now at hand concerning the need for and thorough practicability of preframing treated timber, it is a very pertinent one. As a result one railway has modified its design of open-deck trestles as described on page 375 of this issue and at least one other road is now taking steps in the same direction. The article by Mr. Haggander shows clearly what can be done to eliminate practically all of the field cutting of the materials that go into such structures.

RAIL DEFECTS

Cause and Remedy of Transverse Fissures

Transverse fissures have probably existed as a defect in steel rails since such rails were first rolled. It is certain that they existed to some extent prior to the time when they were called so sharply to attention as the cause of a serious derailment about 20 years ago. Prior to that time, however, they had attracted little attention. Since then they have been under constant study by railway engineers, by rail manufacturers, and by the Bureau of Safety of the Interstate Commerce Commission.

During this time a large amount of information has been collected although disappointingly little progress has been made in determining the fundamental cause of this defect. While definite knowledge is lacking as to the condition leading to the inception and development of transverse fissures, opinion as to the cause is sharply divided.

The most disturbing fact, however, is that the number of transverse fissures reported to the Rail Committee of the American Railway Engineering Association is increasing yearly, the latest report showing an increase of 780 over that for the previous year and a present rate of 17 such failures a day, every one of which is a potential source of disaster, although surprisingly few derailments result from such failures.

To strive for a solution of this problem, the American Railway Association and the rail manufacturers have agreed to finance jointly a five-year program of intensive study of this important subject, and arrangements are now in progress to start the work. A relatively large tonnage of 110 and 130-lb. rail is to be rolled for test purposes. No innovations or changes from standard mill practice are to be introduced in the manufacture of this rail, but a complete record is to be made of every step from the furnace to the track. After the rail is laid, the record will continue to be complete until the test is finished. Other features of the investigation have not been announced, except that the laboratory work will be conducted at the engineering experiment station at the University of Illinois.

The character of the organization behind the project and of the men who are to conduct the tests, as well as the long period over which they are to extend and the amount of money that is to be spent, indicate that a thorough investigation is to be made. It is hoped that definite information can be developed as to the causes of and remedy for these widespread and serious defects with which steel rails are now afflicted. Progress reports as well as the final report will be awaited with interest by a large body of railway men.

Snow-Melting Equipment Saves the Day

These 16 Double-Slips at the Union Station Were Kept Clear by Snow Melters

Recent installations reduced amount of extra labor and improved train operation during a severe blizzard

WITHOUT warning, a blizzard of unusual intensity struck Chicago on Saturday morning, March 7. In addition to a snowfall amounting to 16.4 in., which was the second heaviest on record for this city, the storm was accompanied by winds which reached gale force, with the result that the snow drifted badly. Another feature of the storm was the rapidity with which the snow fell. The record-breaking storm of March, 1930, which brought a fall of 19.1 in., lasted for more than 72 hr., while the storm of this year lasted only 39 hr. Railway men of long experience are practically unanimous in saying that they have never known snow to fall in such quantity as it did for about three hours on Saturday afternoon.

The only comparable storm of record was that of the year previous. During that storm every form of local transportation was completely paralyzed, except railways, and they were so seriously affected that, in most cases, schedules were abandoned and trains were run as was possible. This year, local transportation suffered in the same manner as in 1930. Yet despite the unusual severity of the blizzard and the fact that it was wholly unexpected, railway passenger trains arrived and departed with practically no delay.

The reason for this difference in performance in the two years is attributable, in large measure, to the fact that a number of roads abandoned hand methods of clearing switches during the year in favor of snow-melting and switch-heating equipment.

Key Locations Are Chosen

As might be expected, key locations were selected for these installations. In making these selections, first consideration was given to the improvement that might be expected in train operation. Next in importance was the saving that could be made in the cost of handling the snow. Experience during the recent blizzard has shown surprising results in both of these items.

Two distinct types of snow-melting equipment were employed, and discussion will be confined as nearly as possible to the installations made during the last year and the contrasting results which were obtained from them. Several roads made use of a type of portable open-top oil-burning pots which are placed directly under the rail; several other roads made or extended installations of gas-burning melters; one road continued to use the steam-blowing method, in which the steam is furnished from specially equipped locomotives, and one road used weed burner equipment in one of its large yards.

Oil-Burning Snow Melters

The Illinois Central, the Belt Railway, and the Chicago & Western Indiana, which latter road also operates the Dearborn station, used large numbers of the oil-burning pots, which were distributed at the rate of 8 to 12 to a turnout, while as many as 50 were used at slip switches. Some difficulty was experienced with this equipment at certain points owing to the sudden and unexpected arrival of the storm. Two of these roads were working a five-day week, and had no forces on the ground when the storm broke, with the result that by the time the men arrived the switches were well covered with snow and this combined with the extremely high wind, made it impractical to light the pots for some time. This difficulty was not due to any inherent defect in the equipment, but rather the result of delay in getting men on the job.

The experience of the Illinois Central is typical of the results that were secured from this equipment. The Chicago terminal of this road contains 251 miles of main tracks and 398 miles of yard tracks and sidings. There are 457 switches in the main tracks and 1,552 yard and other inside switches, in addition to 95 double-slip switches. Five large interlockings must also be cared for. Sufficient equipment, 4,000 units, was provided to care for 237 main-line turnouts, 4 single-slip switches, and 41 double-slip switches, a total of 282 switches.

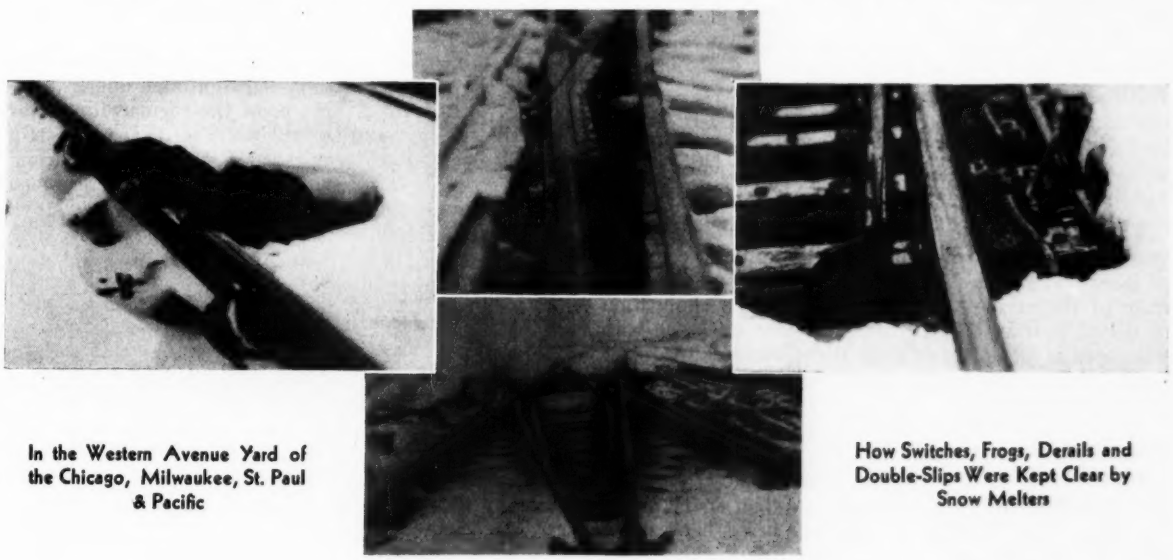
Eighty men were required to tend and refill the heaters with oil, during a 24-hr. period, this being the only force employed on the switches equipped with this device. Previous experience indicated that in a comparable storm, 736 men would have been necessary to keep these switches clear, and that even then there would have been no assurance that train delays would not have occurred.

This year there was no train delay that could be charged to any switch equipped with these heaters, while the difference in cost for the period of the storm was $7,032, including both labor and shovels and snow brooms.

Melts Snow with Weed Burners

At Markham yard, three weed burners were employed to keep the switches and car retarders clear, and this method was very successful. This yard contains 514 switches and 200 car retarder units. Through the use of the weed burners for melting snow, it was unnecessary to augment the regular section force of 35 men in this yard, except near the end of the storm when one of the weed burners broke down, after which it became necessary to rush 80 men to the section of the yard in which it had been working, in order to keep the switches clear.

One weed burner was sufficient to keep the entire 200 retarder units clear and at the same time keep the switches open on the ladders leading from the hump. The hump at Markham was thus in condition for operation during the entire period of the storm, while other roads with car-retarder installations were compelled to suspend hump operation for varying periods, owing to accumulations of snow in the braking mechanism.



In the Western Avenue Yard of the Chicago, Milwaukee, St. Paul & Pacific

How Switches, Frogs, Derails and Double-Slips Were Kept Clear by Snow Melters

Union Station Increases Installation

A complete description of the snow fighting methods and equipment employed by the Chicago Union Station appeared on page 212 of the May, 1930, issue. At that time four double-slip switches had been equipped with stationary heaters which burn commercial gas. During the year this installation was extended to include 31 double-slip switches and 19 turnout switches, or about 60 per cent of the switches and slips in the area served by the two interlocking plants. This installation, which includes a total of 3,318 burners, was made at a cost of approximately $30,000, a figure considerably higher than might be expected in a normal installation, because of the character of the track layout and of the fact that all tracks are practically at river level, many feet below street level.

However, the installation justified all expectations of the benefits to be derived. No extra men were required in the interlocked territory during the entire period of the storm. The regular force, consisting of two section gangs with a total of 15 men, each of which was divided into day and night shifts, was able to attend to the gas burners and at the same time keep clear the switches that were equipped with the suction type of oil torches. Comparing the cost of this storm with that of March, 1930, there was a saving of approximately $2,000, after including the cost of the 1,500,000 cu. ft. of gas consumed. More important, however, no train entering this terminal was delayed at any time during the storm by snow conditions at the switches or in the interlocking.

The Chicago, Milwaukee, St. Paul & Pacific operates an important and extremely busy interlocking plant at Western avenue and Kinzie street, where this road and the Panhandle line of the Pennsylvania cross the main tracks of the Omaha line of the Chicago & North Western. The bulk of the traffic on the Pennsylvania is freight; that on the other two roads comprises both freight and through passenger trains, as well as the important suburban service which they both maintain. The Chicago & North Western operates four main tracks, two for passenger traffic and two for freight. The four tracks of the Milwaukee and Pennsylvania are operated jointly, two tracks being assigned for passenger service and two for freight.

Heretofore the switches and derails at this plant have been cleaned by hand labor, using shovels and snow brooms and during storms of any severity it has been customary to abandon the freight tracks and concentrate all efforts on keeping the passenger tracks open. The average number of men employed, in addition to the regular force, during snow storms, has been 150, while as many as 500 have frequently been required to keep the passenger tracks only open, and delays to trains were common.

An installation of the gas-burning type of switch heater, made in 1930 and consisting of approximately 2,000 burners, was sufficient to fully equip 25 turnouts and derails, 9 double-slip switches with movable-point center frogs and 14 movable-point frogs in the crossings. The installation cost approximately $17,000.

Snow began to fall about 11 a. m. and the storm had developed to major proportions by 11:45. At that time the men started to light the burners, eight men being employed for one hour in lighting the burners and ad-

justing the flame. This force consisted of two trackmen from the C. & N. W., three Milwaukee trackmen and three signal and interlocking repairmen regularly assigned to the plant. As compared with an average force of 150 snow sweepers and a probable force of 500 men during the height of the storm, the largest force engaged was 3 foremen and 17 men during the period of maximum intensity of snowfall on Saturday afternoon. At this time the C. & N. W. assigned 1 foreman, 1 assistant foreman and 7 men; the Pennsylvania detailed 1 foreman and 5 men; the Milwaukee had 5 men including the 3 signal maintainers and repairmen, making a total force of 20 men, which was assigned more as a precautionary measure than because they were actually needed. Furthermore, all four tracks on both lines were open for operation during the entire period of the storm, and no train delays occurred which were chargeable to the operation of the interlocking plant.

The comparison of cost between this storm and that of March, 1930, for keeping this one plant open is impressive. The 1930 figures cover all labor and supplies, including brooms and shovels. The 1931 figures include all labor and supplies and the cost of the gas consumed by the switch heaters.

	Total Cost
March, 1930	$3,962.04
March, 1931	1,095.48
Difference	$2,866.56

This sum represents a return of approximately 17 per cent on the original investment, as the difference in cost of labor and supplies only. It does not include any estimate of the savings that resulted from the elimination of delays to trains; from having all four tracks on both lines open at all times; or from the elimination of derailments which occur so frequently at interlockings during severe snow storms.

The Chicago terminal of the Chicago, Milwaukee, St. Paul & Pacific comprises 82 miles of main track, 278 miles of yard tracks, and approximately 2,000 switches. Switch heaters are not used elsewhere than at the Western Avenue interlocking, all cleaning being hand work. During the storm under discussion, the regular force of 100 track men was augmented by casual laborers to the number of 1,800, or the equivalent of approximately one man to every switch.

Because of its exposed situation and the intricate arrangement of tracks approaching its Chicago passenger station, the Chicago & North Western has always suffered severely from snow storms of any intensity. Within a short distance from the station six interlockings, including the one at Lake street, which handles the station layout, are required to control traffic movements at junctions and diversion points. At two of these, it is possible, for limited periods, to set up the through routes and thus avoid delays from snow-filled switches.

During the past year the remaining four plants were equipped with snow-melting devices of the gas-burning type, as follows: Lake street, 18 double-slip switches, 3 single-slip switches and 1 turnout, 2,800 burners; Sangamon street, 6 double-slip switches and 16 turnouts, 580 burners; Division street, 3 double-slip switches and 21 turnouts, 878 burners; Carpenter street, 4 double-slip switches and 11 turnouts, 878 burners—a total of 4,882.

Since the experience at each of these plants was similar and to avoid too much detail, only the methods employed at Lake street will be mentioned. As has been mentioned, this plant controls all movements into and out of the trainshed. As the tracks leave the trainshed they turn to the west, at approximately right angles, so that the entire converging layout is on a sharp curve.

During severe snow storms in previous years, it has been necessary to employ at Lake street an extra force of 425 men, working in three shifts, and an additional force of 50 men during the period of maximum intensity. Even with the closest supervision, delays have often been excessive and derailments frequent. As a result of the installation of snow-melting equipment, no extra men were employed this year, since it was found entirely practicable to handle the plant during the height of the storm with the regular section gang, consisting of 1 foreman and 6 laborers, and 3 interlocking repairmen. In fact, the section gang was released at 5 p. m. Saturday, while the storm was still at its worst, and did not again report for duty until Monday morning. The regular night shift of three repairmen took care of the plant on Saturday night, while it was handled without difficulty by two repairmen on Sunday. During this entire period no derailments occurred and there were no trains delayed by the operation of the plant.

The experience at the remaining plants was similar, no extra men being required. At Sangamon street, where 150 extra men are usually required, the plant was handled by the regular force of 6 section men and 2 interlocking repairmen. At this point the regular force was retained during Saturday night. The Division Street plant has heretofore required 115 extra men. During the present storm a force of 5 trackmen and 2 signal men handled it with difficulty. Likewise, at Carpenter street 4 trackmen were employed on Saturday as compared to this force and 110 extra men prior to the installation of snow-melting equipment.

Other Methods

For many years the Chicago, Burlington & Quincy has relied on the steaming method of keeping its switches clear during snow storms. This year it had an installation of the oil-burning type of switch heaters at one interlocking plant and obtained results similar to those on the other roads using this equipment. Elsewhere on its extensive terminal, which includes 6 interlockings, 40 miles of main tracks, 360 miles of yard tracks and sidings and 1,950 switches of all types, reliance was placed on the use of 40 locomotives which are equipped for blowing the switches clear with steam. During this storm, however, the regular force of 125 trackmen was augmented with 400 casual laborers.

The Baltimore & Ohio Terminal comprises 126 miles of main tracks, 165 miles of yards and sidings, 10 interlocking plants, 469 main track switches, 852 yard and interior siding turnouts, 159 steam railway crossings and 28 electric railway crossings. This road employs a regular track force of 200 men and has 46 interlocking repairmen, signal maintainers, and lampmen. No extra men were employed on Saturday, although 80 were required on Sunday and 30 on Monday. The only snow-melting aid employed by this road was at its bascule-lift bridge over the Chicago river, where a special thawing salt was used to remove the accumulation of ice on the shoes and bridge seat, which interfered with the locking mechanism after operation.

In brief, the limited installations of snow-melting equipment which have been described protected a total of 844 turnouts, 102 double-slip switches, 7 single-slip switches, 14 movable-point frogs and 200 car-retarder units. Based on past experience, it is estimated that in this one storm, these installations reduced the amount of extra labor which would otherwise have been required by the equivalent of 5,683 men for one 8-hr. shift.

The Use of Treated Timber in Construction *

By F. O. DUFOUR

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IT IS rather difficult to compute the total saving in acreage effected by the preservative treatment of timber, but an approximate estimate of the saving in the case of crossties is indicative. In 1907 approximately 25 million acres were required to produce the crossties purchased, whereas in 1927 only 17 million acres were required, or some 8 million less acres than in 1907. This was due to the fact that about 50 million crossties less were purchased in 1927 than in 1907. This decrease was due very largely to preservative treatment, which resulted in the increased life and service of the used ties.

The annual production of material which could be creosoted is approximately 42 billion board feet, of which lumber and sawed ties comprise 90 per cent and hewed ties 5 per cent. A large portion of the lumber is used for purposes where it is unnecessary or uneconomical to treat it. Yet since the total of timber treated in the United States in 1929 was 4 billion board feet, or about 10 per cent of what might be treated, it is evident that there is abundant opportunity for a substantial increase in the use of treated timber.

A Common Use of Treated Timber

That the use of treated timber other than track ties is on the increase is indicated by the fact that one large railroad used 42 million board feet last year, or 46 per cent more than in the previous year. Two large systems used about 60 million board feet for purposes other than track ties in 1929.

Some of the Advantages

A great advantage of a treated timber structure is that it can readily be added to or remodeled and in case it becomes obsolete the salvage value is high. The use of wood also allows work in low temperatures without special provision. The disadvantages are in the case of some treatments, odor, liability to soil objects coming in contact with it and difficulty in retaining a presentable coat of paint. The odor has never been very objectionable, soiling can be taken care of by encasement or veneering and some success has been had with special paints; so that it is probable that the problem will be solved.

It is claimed also that some treatments are a fire hazard, but this has not been proved satisfactorily to the speaker. Other treatments claim to be fire retardent to some extent; and this claim has been substantiated. The speaker's experience has been that it is much more difficult to ignite timber treated with a material supposed to be an added hazard than to ignite untreated timber, and also that it is much more difficult to extinguish a fire, once ignited, until the free oil and gases have been burned away.

Opportunities for Greater Use

Large quantities of creosoted timber are used for trestles, both open and ballast-decked, and the field has not been much more than scratched. Several years ago a western trunk line recorded having about 140 miles of timber bridges, most of which were, of course, trestles. There are a number of trestles now in use on various railroads that have been in service from 24 to 30 years and have required little or no maintenance except that due to strengthening on account of increased loading. The deterioration due to decay has been small, and much of this decay has been caused by conditions due to overloading. Even this has been mostly confined to the crushing of caps. Ballast-decked trestles and ballast-decked steel bridges offer a wide field for the increased use of treated timber.

Treated timber culverts have been in use for 28 years and have shown no sign of deterioration except a little decay at the end of the stays which had been sawed off in the field and not properly treated. The use of sheet piling left in place for construction other than water work is recommended since it does not rot out and thereby tend to produce settlement of adjoining structures.

It is the speaker's belief that the methods of treatment have increased materially in efficiency in the last few years. It is also his belief that the life of treated structures built over ten years ago has been materially decreased by improper handling and by the fact that they were not preframed or did not have the field cuts properly treated to prevent decay.

Long Service Life

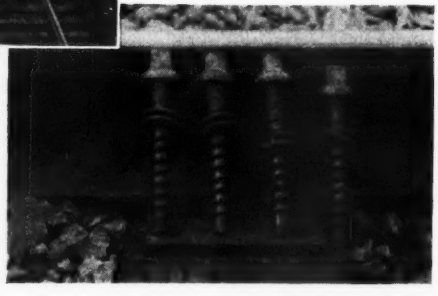
The Lake Pontchartrain trestle of the Southern, which is of treated timber, has been in service for 48 years in a sub-tropical climate with an annual rainfall of 56 in., where untreated timber usually lasts less than 4 years. Yet, less than three per cent of the original material has been removed from the structure because of decay. In 1911 the structural engineer of the Valuation division of the Interstate Commerce Commission estimated the remaining life to be 35 years and the total life 73 years. It is the belief of the speaker, who has inspected a great number of treated timber structures, that with the methods of treatment and care in handling and construction that we have today, properly treated timber, other than track ties and structures subjected to considerable abuse from overloading, will have a life of from 50 to 75 years.

The decision as to whether to use treated timber is an economic one. The season of construction, the construction schedule, the design, the location, the use to which the structure is to be put, the life of the structure, the salvage value, the ease with which the capacity can be increased, and indirect costs as well as the direct cost and the maintenance, are some of the more important factors to be considered.

*Abstract of a paper presented before the annual meeting of the American Wood-Preservers' Association at Philadelphia, Pa., Jan. 27-29.

Erie Adopts Special Track Details

Standard tie plate secured to ties by screw spikes fitted with spring washers is used also on joint ties

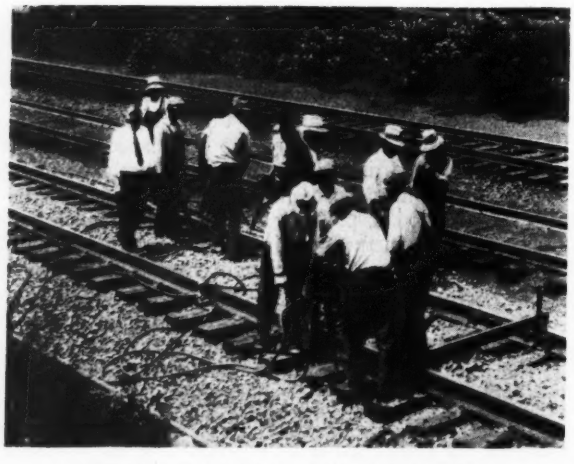


At the left—A Stretch of Reconstructed Track on the Erie With the "V" Ballast Section in the Intertrack Space

Center—A Close View of Four Lag Screws with Double-Coil Spring Washers

IN connection with an extensive program of strengthening and improving track conditions on the Erie, in the course of which 65 miles of main-line track was rebuilt in 1929 and 84 miles was undertaken in 1930, several unusual features in track construction have been adopted. The more important of these include a specially designed tie plate for use alike on joint and intermediate ties, and the use of double-coil spring washers in connection with lag screws for holding the tie plates securely to the ties independent of the rail. Other interesting features include a change in the shape of the ballast section in double-track territory and the extensive use of power tools in carrying out track work.

In recent years, standard track construction on the Erie has included 100 and 110-lb. R. E. rail in 33-ft. and 39-ft. lengths, employing 24-in., four-hole, 100 per cent angle bars; four-hole tie plates throughout with a 1-in-40 cant; and two cut spikes to the plate, holding the rail. In the new standard of construction for main-line tracks, 130-lb. R. E. rail in 39-ft. lengths is used, in conjunction with a three-tie supported joint employing 39-in., 6-hole, 100-per cent, head-free angle bars with two spiking slots at each end.



Power Tools Are Used in Rebuilding the Track

Tie Plates Have Special Features

The new style tie plates are 12 in. long by 7½ in. wide, with one rail shoulder. and have a rail seat with a cant of 1 in 40. These plates, which weigh 15 lb. each, are ½ in. thick at the heel and toe, with a maximum thickness of ¾ in. immediately inside the rail shoulder. Each plate has eight spike holes; four ¾-in. by ¾-in. holes for diagonal spiking of the rail with 6-in. cut spikes, and four round holes, $^{15}/_{16}$ in. in diameter, for diagonal lagging of the tie plate securely to the tie, independent of the rail.

A special feature of the new tie plates is the fact that they are designed for use on both intermediate and joint ties. This is made possible by the size and spacing of the round holes, these holes being of sufficient size to take a cut spike, and so located that when the plates are used at joints, the holes are in position for spiking through them to a bearing on the flange of the angle bar.

The round holes in the plate are used for cut spikes only at the middle tie of the three-tie supported joint, and, of necessity in these cases, lag screws are dispensed with. At the other two ties at each joint the square spike holes are used for the usual diagonal spiking with cut spikes, the spikes being driven through the slots provided near the ends of the joint bars, and no lag screws are

Method of Spiking Joint Ties With the New Standard Tie Plates. In the Insert—The Old Standard Joint Construction

used. Thus, while all intermediate tie plates are lagged to the ties by means of two screw spikes, and the rail is held independently by two cut spikes, except where double spiking is deemed necessary, the joint tie plates are held only by the cut spikes used in either the round holes or, through the joint bar slots, in the square holes.

Spring Washers Used Under Lag Screws

Along with the features of the tie plates already mentioned, is the fact that they were designed to what were considered to be the most economical proportions, taking into account the manner in which they were to be lagged to the tie. Thus the plates are slightly shorter than those used on a number of roads, but purposely so because of the feeling that less length is required when the plate is made an integral part of the tie by means of lag screws.

To insure this relationship between the tie plate and the tie, regardless of any compression of the wood fibers or wear of the tie, the Erie experimented with, and has now adopted as standard, the use of a double-coil heat-treated spring washer, under the head of each lag screw. These washers, which were designed specially for this purpose, have a free take up of $^{11}/_{32}$ in. and a reactance pressure of 3,000 lb. They are manufactured from $^{3}/_{8}$-in. by $^{13}/_{64}$-in. stock and are provided with a $^{31}/_{32}$-in. hole. The overall diameter of the washers is $1^{23}/_{32}$ in. and their overall depth, when not under load, is $^{3}/_{4}$ in. By means of these washers it is expected that all movement between the ties plates and the ties will be prevented, regardless of some compression of the wood fibers under the plates, which is to be expected, and, therefore, that tie plate rattle under traffic will be eliminated, with much of the abrasion of the ties which occurs where the plates are allowed to lie loosely on the ties.

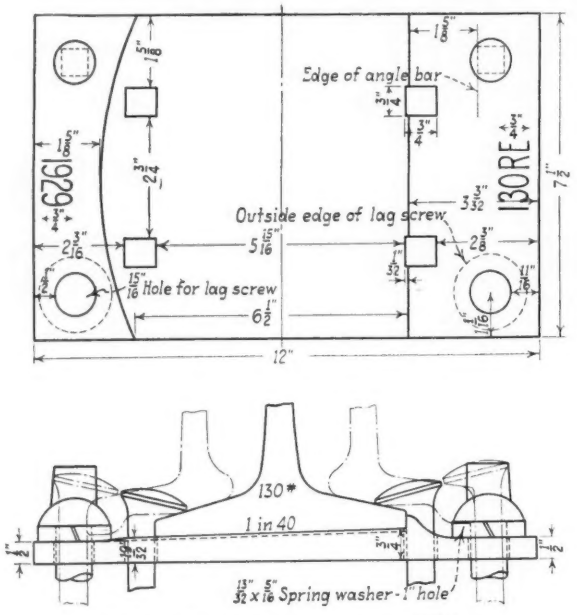
The lag screw of the Erie, which is $6^{1}/_{2}$ in. long under the cap, differs mainly from similar screws used on several other roads, in that it has a square wrenching head and provides a smooth horizontal surface on the underside of the cap for uniform bearing on the spring washer. These screws, which are used only in holes prebored in the ties, have a minimum diameter of shank of $^{9}/_{16}$ in. at the point, and a maximum diameter of shank of $^{7}/_{8}$ in., immediately under the cap.

In all of the track reconstruction on the Erie, power tools are being used extensively, these including air-operated wood drills for boring the old ties in the track, a tie scoring machine, pneumatic screw-spike drivers, and pneumatic tie tampers for resurfacing work. In carrying out the work, after the ties have been scored, the rail is renewed, with such auxiliary work as adzing of the ties, changing of the tie plates, and all cut spiking. Setting of the lag screws is deferred a month or so, until a resurfacing gang goes over the track and makes such tie renewals as may be necessary, or even later, after surfacing has been completed. This is done to allow the new plates to seat themselves on the ties, and to avoid the unnecessary boring and spiking of ties scheduled to come out of the track during the surfacing operations. Too great an interval between the rail renewal and lagging of the tie plates is avoided, especially in curved track territory, because of the possibility that the track will get out of gage before the lag screws are set.

Present standards on the Erie call for the exclusive use of A. R. E. A. No. 4 and 5 ties, 7 in. by 8 in., and

A Close View of a Section of Track on the Erie Completely Rebuilt to the New Standard—Note Supported Joint on the Right

7 in. by 9 in., and 8½ ft. long, treated with creosote and prebored for both cut and screw spikes. Twenty-four ties are used to the panel, with uniform spacing, except at the joints where the spacing is slightly closer in order to get three ties under the 39-in. joint bars. A further expedient employed at the joints to secure as much room

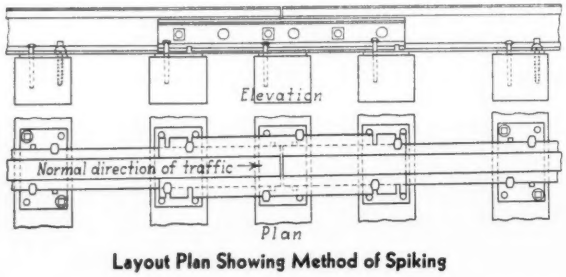


Plan and Cross-Section of the New Tie Plate

between ties as possible for tamping, is to use No. 4 ties, with 8-in. face, directly under the rail ends, and to place the plates on the adjoining ties on both sides flush with the inside edges of the ties.

Changes Made in Ballast Section

Another change in the main-line track structure of the Erie is in the shape of the ballast section, which calls for crushed rock to a depth of 10 in. below the bottom of the ties. The new section provides a 6-in. ballast shoulder on



Layout Plan Showing Method of Spiking

tangents and on the inside of curves, and a 12-in. shoulder on the outside of curves.

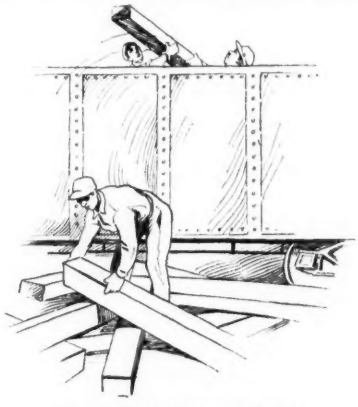
The most important change in the ballast section is in connection with that for double-track in outlying territory, where a level section across the inter-track space has been changed to a "V" section, with side slopes of 1¾ to 1, extending from the inside ballast shoulder of each track. At interlocking plants, station grounds, and points where there is any considerable amount of switching, or where trainmen and others may have occasion to walk about on the track, the level ballast section in the inter-track space is retained.

With this new feature in the double-track ballast section, which is being incorporated wherever possible in connection with ballast cleaning and dressing work, it is estimated that a saving of about 400 cu. yd. of ballast a mile is effected. It is also felt that drainage will be improved with the new section, and that, owing to the smaller amount of ballast which will need handling, ballast cleaning operations will be more economical.

All of the changes in the track standards on the Erie have been made under the direction of J. C. Patterson, chief engineer maintenance of way.

The Tale of a Tie

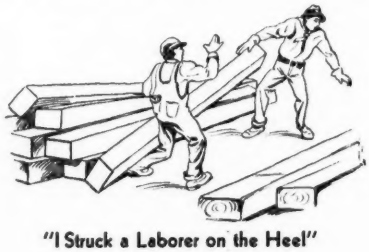
THE Committee on Education of the Safety Section, American Railway Association, presents the problem of safety in the handling of ties from a new and interesting angle in its Circular No. 292, entitled "The Tale of a Tie." This circular is one of a series that is being issued in connection with the three-year program now being inaugurated to reduce accidents 33 per cent by the



"Look Out For Men Below"

end of 1933. The circular presents the story of a tie, as told by the tie itself, from the time it is cut in the woods until it is placed in the track. This story is reproduced in part as follows:

I am a tie; just an ordinary railroad tie such as may be seen piled up along the right-of-way or on the roadbed of any of our great railroads, but with this difference—I can talk. I believe



"I Struck a Laborer on the Heel"

that I have been enabled to talk, so that I can tell my own story to some hundreds of thousands of railroad men throughout the country, many of whom don't seem to have as many brains as I have. I judge by the way they handle me, as I move on my way from the creosoting plant to the roadbed.

One day I found myself, with hundreds of others, loaded in a flat bottom gondola car. I was covered with a durable black coat of creosote, and after traveling for several hundred miles I had my first experience with a section gang.

Some men started to unload me, when another fellow they

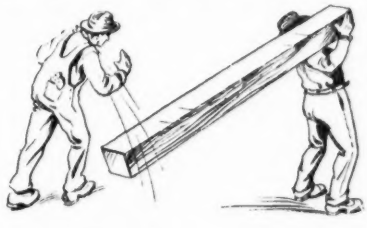
called "Boss" stopped them as they were about to take hold of me and said: "Hold on there, roll your sleeves down, put your gloves on and get some of that black grease ready for your hands. Don't you know that green creosoted ties will burn your hands and arms like acid?"

Well, they got themselves fixed up, and I heard one of them say to the other in an undertone: "I knew it all the time, but I

"I Broke a Couple of Toes for a Guy"

didn't think the Boss would notice it, and I thought I might get by without going to the trouble of protecting myself."

They were not converted yet, it seemed, for they put one end of me up on the edge of the car and started to shove me over without knowing that the man on the ground was clear, but the "Boss" (I afterward learned he was the foreman) stopped them again and made them wait until he got where he could watch every second to see that no one was on the ground in my way.



"Give the Other Fellow a Chance"

After I had lain beside the track for a short time, a young man came along and, catching hold of one end of me, he threw me over against some other ties, and—of all the dumb tricks—my other end flew up and struck him under the chin. I heard his jaw was broken; at any rate I didn't see him again for several weeks. I'll bet his foreman had not trained him to handle me carefully.

Well, I didn't have any trouble while the gang was piling me up with others in a nice pile beside the track, but after a while when they came to haul me to the point where I was to be used,

"They Had to Put Another Man in His Place"

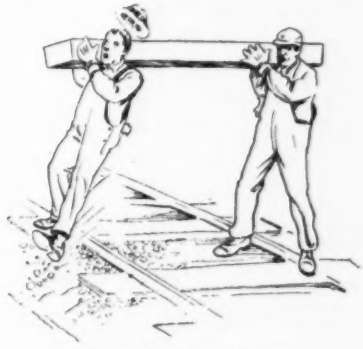
I struck a laborer on the heel when another man turned me over and let me fall off the pile to the ground. I mashed another fellow's fingers when he turned me over on some other ties, and I broke a couple of toes for a guy when I rolled off the truck car because I was not carefully piled.

Then two section men got hold of me, one on each end, and swinging me to their shoulders they started carrying me to my future home. When they got there the fellow in the rear dropped his end first, and as I hit the ground on that end, I saw the man in front double up and go down to the ground with my other end resting on his neck. He must have been badly hurt, as he didn't move and I heard him groan as they carried him away on a stretcher.

The foreman called the guilty bird over and said: "For the love of Pete, why don't you say something before you drop your end? Give the other fellow a chance." And then he called a young lad with a book and pencil and said, "Give this man five days to learn team work."

Well I thought I was starting out with a pretty bum record for a tie that had such rosy dreams of being a Safety Guard; but when I got to thinking it over I decided that none of the trouble had been my fault—just thoughtless, careless, disobedient acts on the part of men.

As they started to drag me under the rails with their picks, one of them fell backward across the rail when his pick failed to hold



"Watch Where You Step"

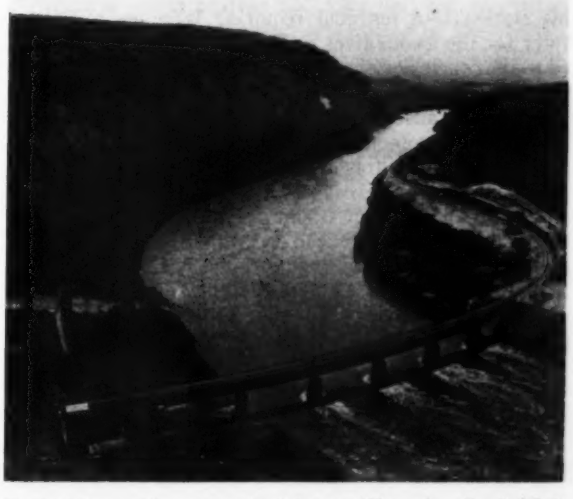
and they had to put another man in his place because he couldn't work with one arm in a sling.

Finally, the spiker got a bruised shin when he failed to set a spike firmly in my bosom. It flew out the first blow he gave it and struck him on the leg.

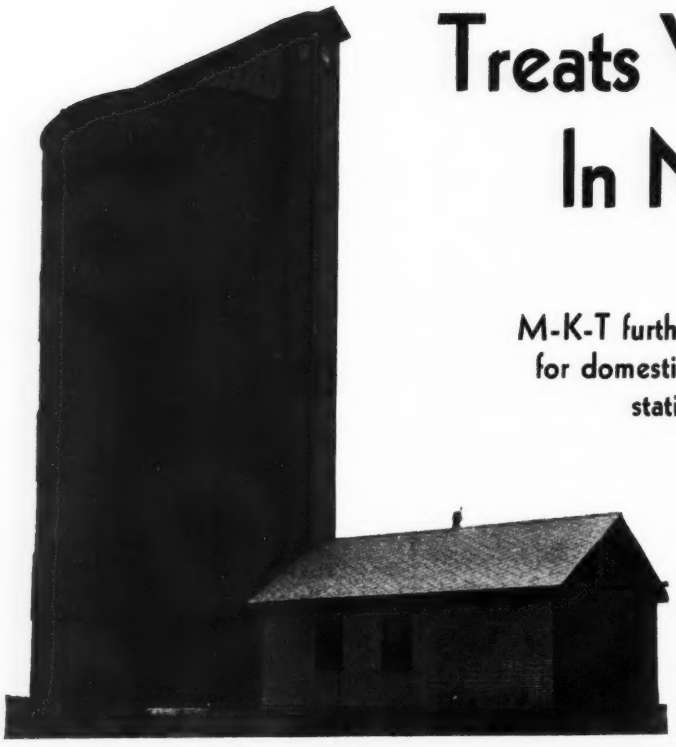
I was sure relieved when the final job of tamping and leveling was finished and for a time at least I might not expect to see the ambulance driving up.

I've only told you of those accidents that resulted in men being hurt. I saw hundreds of other careless stunts that didn't hurt anybody, but some of them were mighty narrow escapes.

If I was a rail or a bridge timber, I could tell you some pitiful stories of accidents that left widows and orphans behind them, which, from my observations were all caused by the same thing: Foremen not looking after their men and the men doing fool stunts without thinking.



On the Missouri River at Lombard, Mont., Where Two Parallel Railways Run in Opposite Directions — N. P. Line on Left to St. Paul, Minn., C. M. St. P. & P. Line on Right to Seattle, Wash.



Treats Water Twice In New Plant

M-K-T further purifies locomotive supply for domestic use in recently completed station at Franklin, Mo.

By R. V. ZAHM
Assistant to the Water Engineer,
Missouri-Kansas-Texas, Parsons, Kan.

The Treating Plant House and Storage Tank.

THE Missouri-Kansas-Texas has constructed and placed in operation at its Franklin, Mo., terminal a water-treating plant which embodies several distinctive features, including equipment for the further purification of a portion of the softened water for drinking and culinary purposes, compactness of design, automatic control, and the proportioning of the chemical by the meter method. The source of supply for the plant is an impounding reservoir approximately one-half mile from the treating plant, in which the quality of the water remains fairly constant, the total hardness ranging from 5.0 to 7.5 grains per gallon and the suspended matter from 4 to 20 g.p.g.

Although this water supply is low in hardness the amount of suspended matter contained and the fact that this station is a terminal requiring large quantities of water for the locomotives working through this territory, led to the conclusion that distinct economy could be effected by removing the hardness and suspended matter and imparting a caustic alkalinity to inhibit the pitting and corrosion of locomotive tubes and boilers, which had become a problem on this district. Lime, soda ash and sodium aluminate are the reagents used in softening the water and in order to render it suitable for drinking purposes the causticity is neutralized with alum and sterilization is effected by means of sodium hypochloride.

The reservoir water enters the plant through an 8-in. line and, after passing through a 6-in. turbine meter proportioning device, is carried to the top of the steel combination treating and storage tank. This tank is 34 ft. in diameter and 60 ft. high and encloses a downtake tube 8 ft. in diameter. The chemicals and water are mixed by a hydraulic jump into a cone mixing chamber in the top of the downtake, no mechanical agitation being used. The lower 30 ft. of the tank is used for treating space and provides a reaction time of 6.8 hr. when the plant is operated at its capacity rate of 30,000 gal. per hr. However, a maximum settling time of 13.8 hr. is obtainable by means of the upper portion of the tank which has storage capacity for 200,000 gal. of softened water. A floating outlet pipe is used to deliver the clear softened water from the top water level in the tank to the crane lines.

Filter Found Not Necessary

No filter is used in this tank. It has been definitely shown by experience on the M-K-T that by designing the treating tank so as to give adequate time for the equalization of temperatures in the downtake to avoid short circuiting and to provide the correct rate of upflow in the tank proper and sufficient time for sedimentation, the use of the filters is not only unnecessary but a source of increased initial and operating expenses. When properly designed for a particular quality of water, such tanks will produce a water free from turbidity.

The chemical proportioning device consists of a Sparling velocity-type water meter fitted with a reduction gear box which is attached to the main shaft of the meter. The main shaft of the reduction gear is fitted with an aluminum drum which is attached to and wound with a light-weight cable, the other end of which is fastened to a swing pipe in the chemical mixing vat. As water passes through the raw water line into the softener, the meter revolves, turning the drum and unwinding the cable which lowers the swing pipe in the chemical vat and thus provides for chemical feed in correct proportion to the amount of water to be treated. The high accuracy of this proportioner is not affected by ordinary changes in the rate of water flow.

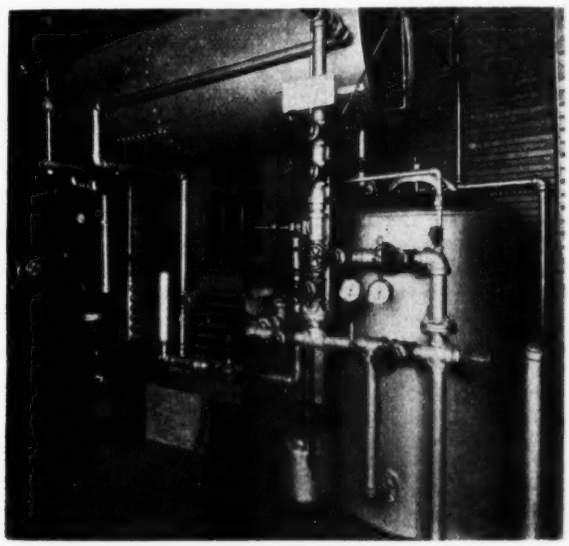
A single mixing vat, 6 ft. 6 in. in diameter and 4 ft. 6 in. high, with a swing pipe to the pump sump is used as a supply tank for both lime and soda ash. Both the mixing vat and a triplex 2½-in. by 2-in. chemical pump

are belt-driven from a single 2-hp. electric motor. The solution in the pump sump is maintained at a constant level by the addition of soft water, the quantity of which is controlled by a float valve. Sodium aluminate is fed separately by means of a National Aluminate feeder and solution box, the solution being forced to the mixing cone at the top of the tank by a small centrifugal pump operated by a one-horsepower motor.

The removal of sludge is accomplished by means of two 12-in. quick-opening gate valves discharging into an open sump which drains to a sewer, the two 12-in. header pipes being fed by a system of perforated laterals covering the bottom of the tank. This system of sludge removal has proved very effective and a minimum amount of water is wasted.

Automatic Operation

Steam pumps located in the power house adjacent to the treating plant pump water from the reservoir to the treating tank. The power control consists of a double-circuit, single-pole Mercoid switch of the American Radiator Company, operating directly on tank pressure and handling a 110-volt circuit which controls the hold-



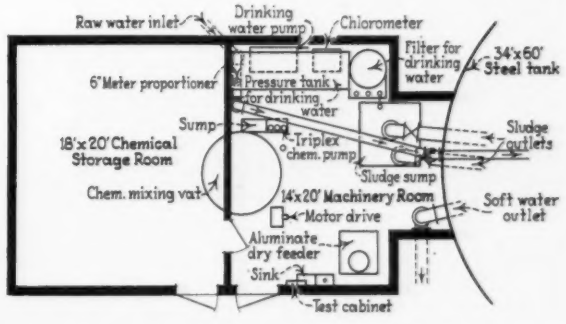
The Drinking Water Purification Equipment in the Machinery Room—The Meter-Type Chemical Proportioner for the Locomotive Supply is Shown in the Water Main at the Extreme Left.

ing coil on a master magnetic switch. This switch in turn controls the 440-volt holding coils of two magnetic switches which control the motors that operate the chemical mixing vat, chemical pump and sodium aluminate dry feeder.

A drop of five feet from the overflow level of the water in the combination treating and storage tank causes the Mercoid control to make low contact, thereby energizing the 110-volt holding coil of the master magnetic switch which in turn energizes the 440-volt holding coils of the magnetic switches controlling the mixing vat, chemical pump and sodium aluminate dry feeder, thus placing the treating plant in operation. The Mercoid control also actuates an alarm on a double circuit in the power house, so that at the time the treating plant machinery is automatically started the alarm rings, which is the signal for the power-plant attendant to start the steam pumps. This stops the alarm and places it on high circuit where it is ready to ring when the tank has been filled and the Mercoid switch returns to high contact. As soon as the water level in the steel tank reaches a point one foot below the overflow level, the Mercoid control is thrown to high contact, thereby breaking the 110-volt holding coil circuit of the master switch and in turn the 440-volt holding coil circuits of the machinery switches, thus stopping the treating plant. The Mercoid high contact also rings the alarm in the power plant and the attendant stops the steam pumps and throws the alarm to low circuit.

Also Treats Water for Drinking Purposes

Prior to the erection of this treating plant, there was no safe reliable supply of drinking water at this terminal and it was necessary to haul a portion of the drinking water at considerable expense from a city supply located about 10 miles distant and to curtail the use as much as



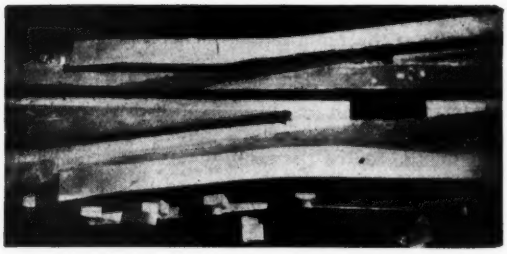
Showing the Arrangement of the Treating Facilities.

possible. In order to provide an adequate safe drinking-water supply for the terminal, equipment for purifying water for drinking purposes was made an integral part of the treating plant. Clear soft water from the floating outlet pipe is admitted to a steel sump, controlled by a float valve. A ¾-in. Wallace & Tiernan Chlorometer feeds sufficient sodium hypochlorite to the water going to the sump to yield a free chlorine content of from 0.1 to 0.2 parts per million. From the sump, the water is picked up by a Fairbanks-Morse simplex self-oiling power pump having a 2½-in. by 4-in. cylinder. The pump is driven by a 2-hp. electric motor and the water is forced through a Graver pressure sand filter 36 in. in diameter. Before the water reaches the filter bed the caustic alkalinity is slightly more than neutralized by the addition of sufficient alum. This pump is capable of delivering 14 gal. per min. against a pressure of 100 lb. The water leaves the filter with sufficient pressure to force it into a 500-gal. pneumatic storage tank.

The drinking water unit operates independently of the power controls governing the operation of the water softener. A General Electric pressure control switch is used to start the purifying machinery when the pressure in the pneumatic tank drops to 40 lb. and to stop it when the pressure reaches 60 lb. This drinking water is also used at New Franklin for watering passenger coaches and two miles of 2-in. cast iron pipe were laid to conduct it to that point.

The treating plant house is 20 ft. wide and 32 ft. long and is of frame construction. It is roofed with asbestos shingles and the interior walls of the machinery room are lined with ½-in. Celotex, while the ceiling is covered with ⅝-in. beaded board. Steam heat coils are used to maintain proper room temperature. The drink-

(Continued on page 377)



An Example
Upper view shows a worn frog and the lower one the same frog after welding.

Out-of-Track Welding Saves in Big Yard

Frog and switch-point work at Proviso terminal of C. & N. W. placed on efficient basis

By CHARLES WISE*

THE Chicago & North Western has placed the frog and switch-point welding operations at its Proviso yard on an efficient and economical basis by adopting the practice of doing this work out of the track and at a centralized location. By reason of the various savings effected by this practice, as well as by other methods that are now being used, the track-welding work in this yard is now being done at a comparatively low cost. The Proviso yard of the C. & N. W., which is one of the largest freight terminals in this country, is situated at Proviso, Ill., about 14 miles west of Chicago. The yard is five miles long and covers 1,500 acres. The total trackage aggregates 230 miles and 100-lb. rail is used throughout. There are 740 switches, all with No. 8 turnouts. Construction of the yard was commenced in 1925 and as the various units were completed they were placed in operation, the entire yard being completed early this year.

Generally from three to ten welding outfits are used in a yard of this size, but so far we have accomplished about as much work with one outfit as is usually accomplished by three to five outfits using other methods. With the yard at its present size and with our present system of welding, it will not be necessary to use more than three welders and one helper, two welders and the helper doing the necessary track work while the third welder takes care of the retarder repair work on the hump.

We find that we can weld frogs out of the track far cheaper than in the track. Almost as much time is spent by the section gang in getting a frog ready for welding in the track as to change the frog out. The bolts must be tightened, the ties tamped up and the frog gaged properly, and extra tie plates and spikes are necessary to prevent the frog from warping. A 100-lb. frog can be changed in less than half an hour with eight men and the cost seldom exceeds $5 a frog.

When trying to weld a frog on a busy lead, a welder is not able to work more than three to four hours out of eight. When the frog is in a switching lead, the welder must stop his work and, since the frog cools during the interval, more gas is required in getting started again. The continual cooling and reheating also have a bad effect on the metal and it is for this reason that the metal scales from many frogs which have been welded under traffic. Also, when welding on a fairly busy lead, switching operations are slowed up materially as the switching crew must always be on the lookout for the welder. Of course, where switching is light and the welder is not interrupted more than about 15 minutes out of every two hours, it is cheaper to weld the frog in the track. Nevertheless, the cost of getting the material to the welder must be considered and this cost will often be out of proportion to the work being done. Also it takes some time for the welder to get started and to store his tools at night.

The building that we have constructed especially for our frog and switch-point welding operations is 20 ft. wide and 24 ft. long and is constructed of second-hand lumber. The floor is of cinders except along one side where a wood floor, six feet wide, is divided into storage spaces for carbide cans and oxygen tanks. The provision of plenty of windows and good ventilation is important, as buildings which have insufficient light and ventilation become uncomfortably warm as soon as a welding torch is started. Welding tables built of scrap rail are provided, on which four frogs at a time may be clamped down. When a welded frog leaves the table very little warping is noticeable.

Centralized Location Advantageous

The building is located near the center of the yard and, thus, only a short time is required for the section gangs to bring their frogs to the shop and to get others in exchange. At present a nearby section gang brings worn frogs and removes welded frogs about once a week.

Some are of the opinion that such a system requires too many frogs, but we have no more surplus frogs than is usual in a yard of this size and perhaps not as many.

*Mr. Wise is in charge of track welding in the Proviso yard of the Chicago & North Western.

We have two surplus frogs for each section or about 28 in all and, considering the number of frogs in the yard, this is not too many. Each section has one usable frog on hand while the remainder are kept on the storage racks at the welding shop. In this way, if one section wishes to change out more than one frog at a time, the extra frogs may be obtained from the rack at the welding shop. Incidentally, the centralization of our welding operations permits us to use an acetylene generator, which saves from $0.46 to $1.00 for each 100 cu. ft. of acetylene used, depending on the kind of generator and the carbide used. This saving alone amounts to about $500 a year for each outfit.

The amount of work one welder and a helper can do in a shop is surprising. No time is lost, even during bad weather. While the welder works on one frog, the helper is preparing another. All the small jobs of cutting which are brought to the shop are done by the helper, who occasionally goes out with a section gang when it is necessary to cut some rail. In short, the helper does all of the small miscellaneous jobs while the welder is concerned mainly with the welding of frogs and switch points and repairs to track tools.

We repair almost all of our switch points out of track, these also being brought to the welding shop. It is sometimes considered somewhat dangerous to weld switch points in tracks because of the large number of failures. We encountered the same difficulty in this yard until we undertook to weld them out of the track, since which time only two welded points out of 240 have failed and these because they were placed against stock rails that were in very poor condition. Most of the welded points actually have a longer life than new points. We repair points which require that the weld be started as far back as 36 in. from the end of the point. Welded switch-point protectors are put on before the point is placed in the track as there is then no likelihood of the rail becoming surface bent, which is often the case if the protector is applied in the track and a train passes while the rail is hot. Using our system, the welding of switch points costs from $2 to $5.

Some New Devices

We have also developed a method of welding the guard rails on self-guarded frogs. In order to do this successfully the frog should be removed from the track, for otherwise a derailment might easily result if a train should pass before the welder has time to make a long run-off on his weld. When putting metal on the guard rail we use an excess of acetylene in order to make the metal so hard that it will withstand the abrasive wear it receives.

In connection with frog welding we have made two special flatters which enable us to do faster and better appearing work. One of these we call an edge flatter, the face being V-shaped in order to give the rail the same rounded edge as a new rail. After welding a few guard rails on self-guarded frogs, an idea occurred to me for another flatter which we now call the side flatter. One edge of this flatter is 1½ in. thick, tapering to a thickness of ¼ in. at the other edge. When this flatter is laid on the rail, with the thick edge against the guard rail the head stands out at such an angle that the helper can easily strike it with a sledge hammer. The face lies flat against the guard rail so that a smooth, flat surface is the result. Other than these flatters, we finish the rail in the usual way with regular flatters and a hot cut chisel.

The practice of welding frogs as soon as they begin to show a little wear, which is quite prevalent, is poor economy in any track except perhaps main lines. A frog can be kept in the track only as long as the entire wing rail and the point are in reasonably good condition. If we assume that this is about two years and, further, that we weld the frog after it has been in the track only about three or four months, this means adding from two to four pounds of steel. Since this frog could still go eight or ten months without welding, such a procedure would result in welding the frog from five to seven times to keep it in the track two years, whereas two or three weldings would be sufficient. Of course, the longer we let a frog go without welding the greater the amount of steel required, yet the cost of putting on eight pounds is only slightly more than that of putting on two to four pounds. In other words, it is my opinion that frogs should not be welded before they require from seven to ten pounds of steel per frog.

Good Judgment Required

However, frogs should not be left in the track too long. A frog has been in the track too long if it requires 11 lb. or more of steel to weld it, but it still pays to repair the frog if the wing rails and the points are in fair condition. This refers to No. 10, or under, 100-lb. open-hearth or Bessemer steel frogs. Frogs of No. 12 angle and up might take from 12 to 25 lb. of steel and still be worth welding because the cost of these frogs, when new, is high. I have had several No. 8 self-guarded frogs of 100-lb. section which required as much as 21 lb. of welding rods per frog, making the total cost of welding from $35 to $40. However, this still shows a large saving as a frog of this kind costs from $112 to $130 new. Our frogs require an average of 7 to 14 lb. of steel per frog and cost between $15 and $28. This includes the renewing and tightening of the bolts when necessary and the building up of the rail ends and the guard rails on self-guarding frogs.

In order to have the frogs welded at the proper time, the roadmaster has given the writer authority to make a regular inspection of the frogs and to mark those to be taken out and welded. The section foreman then takes the frog out as soon as it is possible for him to do so. An experienced track welder can make these inspections and the little extra cost is soon saved in the reduced cost of the welding.

The following is a record of the work that was accomplished at the Proviso yard between January 1 and December 31, 1930, in which period 305 days were worked.

Frogs Reconditioned

No. 7, 90 lb.	5
No. 7, 100 lb.	20
No. 8, 100 lb. (Self guarded)	104
No. 10, 90 lb.	4
No. 10, 100 lb.	27
Total	160

Switch Points Welded

90 lb., 15 ft.	20
100 lb., 15 ft.	122
100 lb., 16 ft. 6 in.	35
100 lb., 25 ft.	4
Total	181

Miscellaneous

Bent switch points straightened	37
Guarded rails welded on self-guarded frogs	154
Butt welds made on broken points and wing rails of frogs	10
Butt welds made on rails	2
Bent points and wing rails on frogs straightened	5
Gage plates made	167

Picks sharpened	170
Switch point protectors applied	21
Joints built up	227
Rails cut	332
Bolts cut	1,650
Switch tie rods straightened	9
Broken gage rods welded	15
Switch lamps repaired	9
Rail ends built up on frogs	300
Frog bolts reconditioned	100

Other miscellaneous work consisted of bronze welding track jacks, welding broken switch-lamp sockets, welding switch-stand handles, lengthening or shortening switch connecting rods, loosening nuts on bolts, tightening and renewing frog bolts, etc.

This work required the use of the following:

Oxygen	95,260 cu. ft.
Acetylene (tank)	10,200 cu. ft.
Acetylene (generator)	84,740 cu. ft.
Steel welding rods	8,019 lb.
Bronze rods	15 lb.
Cast iron rods	5 lb.
Stellite	3 lb.

With the exception of three of the 100-lb. No. 10 frogs, all frogs were welded out of the track as were all of the switch points except 10. The frogs required an average of about 8 lb. of steel each and the switch points about 1½ lb. each. A few of the frogs required only 5 lb. of metal while others required as high as 21 lb. The cost per frog ranged between $14 and $35.

In my opinion every railroad should have a track-welding supervisor who is thoroughly familiar with the road's track-welding needs. He should have six years or more of track-welding experience, of which three, at least, should have been spent on the road of which he is supervisor. This supervisor and the instructor furnished by the company which provides the welding apparatus should work together, it being the duty of the instructor to keep the supervisor and the welders posted on the latest developments in welding methods.

I believe also that the railways would effect a large saving if all welding work were so arranged that the welding forces could be maintained throughout the year. With this arrangement the welders are always experienced men and it is not necessary to break in new men from time to time. Furthermore, the road is assured of obtaining a uniform quality of welding work.

Early Recall of Flagman Causes Accident

THE action of a track foreman in recalling a flagman before making certain that the track was safe for traffic was given in a report of the Bureau of Safety of the Interstate Commerce Commission as the cause of the derailment on January 17 of an extra freight train on the Missouri Pacific, which resulted in the death of the engineman and the injury of the fireman and the brakeman. The scene of the accident was at the installation of a spur track near Carlton, Kan. The report is abstracted in part as follows:

This accident occurred in single-track territory on an unfinished spur track at a point about 165 ft. east of the switch, which is located nearly a mile west of Carlton. Approaching the switch from the west is a 1 deg. 2 min. curve to the left, 965 ft. in length, followed by tangent track to and beyond the station. The switch is located on this tangent at a point 235 ft. from its western end.

The spur track parallels the main track on the north and the switch is a facing-point switch for eastbound trains, leading off the main track through a No. 10 turnout. At the time of the accident, the switch had been completely installed but the rail bender had not been removed, and about 165 ft. of the track had been completed. The right rail had been spiked for an additional distance of 235 ft., while the ties had been distributed and spaced, and the rails laid on top of the ties on the balance of the track.

How the Derailment Occurred

The eastbound freight train was an extra and consisted only of a caboose and the engine. This train departed from Gypsum City, 7.21 miles west of Carlton, at 4:10 p. m. and the accident occurred about 4:20 p. m. The train was traveling at a speed estimated to have been between 30 and 35 miles per hour when it rounded the curve and entered the open switch, being derailed after reaching the uncompleted portion of the spur track. The engine, tender and caboose remained coupled and came to rest on their left sides, parallel to the track, considerably damaged.

The extra gang foreman in charge of the gang of six men which was working on the construction of the spur track, testified to the effect that a short time before the train was seen approaching, he told the men to remove the rail bender as the rail had been bent sufficiently, and at the same time he sent one of the men out after the flagman. He then walked back to the frog, where he supervised some work, and while there he was told that a train was approaching. He then saw that the men were still trying to remove the rail bender from the rail.

The laborer who was in charge of bending the rail stated that in order to accomplish this it was necessary to unlock the switch. After this was done and the rail was bent, an effort was being made to remove the rail bender when the train appeared.

Did Not Follow Regular Procedure

It was disclosed that the regular procedure in installing a main-track switch was not followed in this instance, the switch being completely installed with the exception of bending the rail, which operation was done last after the rail bender arrived about 3:30 p. m. It was also shown that it was necessary to open the switch in order to bend the rail properly.

The conclusions of W. P. Borland, director of the Bureau of Safety in fixing the responsibility for the accident are as follow: "The investigation disclosed that the installation of the switch involved was just being completed when the extra train arrived. The bending of the rail was the last thing that was done and it was necessary to have the switch open during this process. The rail had been bent and the extra-gang foreman had given instructions to have the rail bender removed, and at the same time had sent one of the laborers to return with the flagman. The extra-gang foreman then supervised some other work, not noticing that the switch was open, and paid no more attention to the removal of the rail bender until he heard someone say that the train was approaching, at which time the laborers were still engaged in trying to remove the rail bender. This foreman is responsible for the occurrence of the accident in not seeing that the rail bender had been removed and the switch lined for the main track before he sent for the flagman to return."

Excavating in "Mud Cut", Showing the Old Wall on the South Side of the Original Tracks

Lackawanna Cures Soft Spots By Simple Methods

Fibrous peat and fine clay deposits in glacial moraine country presented problems in recent third and fourth-track work

IN the construction of about 20 miles of third and fourth tracks on its freight line between Hoboken and Denville, N. J., the Delaware, Lackawanna & Western encountered a number of puzzling track foundation problems which were solved satisfactorily. The meeting of such problems in this work was not at all surprising; in fact, such problems were anticipated, because at certain points in this territory the sub-soil conditions were known to be very unsatisfactory. Just where to expect trouble, however, was a matter of conjecture, and, as a matter of fact, the most difficult problems occurred where they were not expected.

From studies made of the sub-soil conditions in this part of New Jersey, it is generally believed that this whole section is underlain with glacial moraines traversed by long extinct and filled-in water courses. This belief is due to the fact that in general the sub-soil consists of a thick bed of gravel traversed by irregular vertical seams of earth, clay and fibrous peat, ranging from a few feet to about 1000 ft. in width, and in many instances extending to great depths. Many evidences of this general condition were encountered in the third and fourth-track grading work, and at one point it was found that the shifting of a bridge about 50 ft. would have afforded a firm gravel foundation instead of the unstable earth formation encountered at the site.

In view of the stable condition of the two original tracks of the line, and lacking records of difficulties encountered in building these tracks about 60 years ago, there was hope that the traffic over the original tracks through the years had sufficiently stabilized the adjacent ground to carry the two additional tracks over the weaker spots without difficulty. No doubt this proved true at many places, but at three points in particular, this situation did not prevail, and the difficulties encountered in the original track construction again arose.

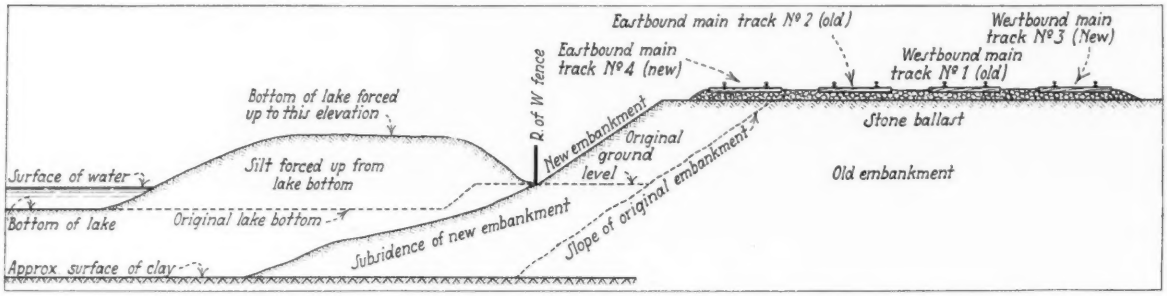
One of these points was about 1½ miles east of Denville where the line skirts the shore of one of the artificial Rainbow lakes on a fill about ten feet high. No trouble was encountered in building the fill on the north side of the old line for the new westbound track, but one night, while it was still under construction, the new fill for the new eastbound track along the south side of the old tracks, slid throughout a length of about 400 ft. and pushed up a sizeable island in the lake, about 40 ft. from the railroad.

That this was due to striking a saturated viscous subsoil, surmounted by more stable surface material was evidenced by the fact that the adjacent right-of-way and the right-of-way fence between the tracks and the island formed in the lake, were not disturbed in the transfer of material which occurred. Investigation disclosed a saturated peat bed under the subgrade, but as there was no evidence that the old tracks were supported on other

than a deep earth fill, it was decided to rebuild the sunken fill with additional material in the hope of establishing a balanced condition in the sub-soil which would support the fill and railroad traffic. In accomplishing this, about 5,000 cu. yd. of additional earth were put into the embankment, and except for what might be called normal settlement, no further difficulty has been encountered at this point.

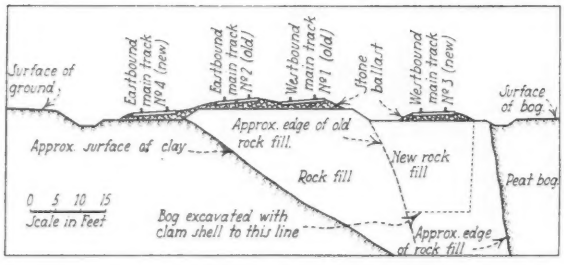
Rock Fill Stabilizes Deep Peat Bed

About one mile east of Denville, more or less similar trouble was encountered through a distance of about 300 ft. in seeking a foundation for the additional westbound track immediately north of the old tracks, although, in this location the tracks are practically at the


Eastbound main track No 2 (old)
Westbound main track No 3 (New)
Eastbound main track No 4 (new)
Westbound main track No 1 (old)
R. of W fence
Bottom of lake forced up to this elevation
New embankment
Original ground level
Stone ballast
Surface of water
Silt forced up from lake bottom
Old embankment
Bottom of lake
Original lake bottom
Subsidence of new embankment
Slope of original embankment
Approx. surface of clay

Subsidence of the New Fill Forced Silt Up and Produced an Island in the Lake Near Denville

ground level in what appears to be dry territory. While difficulty was anticipated at this point, the first actual indication of trouble was seen in the spongy action of the soil under the load of grading equipment, and it was therefore decided to test the foundation for the new westbound track with an engine load before cutting the new track in service. In this test, the soil began to give


Surface of ground
Eastbound main track No 4 (new)
Eastbound main track No 2 (old)
Westbound main track No 1 (old)
Stone ballast
Westbound main track No 3 (new)
Surface of bog
Approx. surface of clay
Approx. edge of old rock fill
New rock fill
Rock fill
Peat bog
0 5 10 15
Scale in Feet
Bog excavated with clam shell to this line
Approx. edge of rock fill

Rock-Filled Trench Provided a Stable Foundation

way immediately, and the temporary track structure sank about 15 in. before it was possible to run the locomotive off. Immediately upon the removal of the locomotive the track came back to its original elevation.

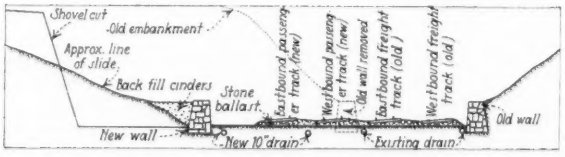
Tests of the soil indicated that the tracks at this point crossed a deep fibrous peat bed, which was entirely unsuited for the track foundation. Excavation also indicated that the two original tracks across this bed had been constructed on a fill of rock, which, presumably, so distributed the track load as to provide a stable roadbed. In view of the effectiveness of this type of foundation under the old tracks, it was decided to use the same form of construction under the new westbound track. In building this, a trench about 16 ft. wide, 15 to 20 ft. deep, and 300 ft. long was excavated adjacent to the existing westbound main by means of a clamshell, the material removed being a fibrous peat which had a consistency similar to cheese, and which became less stable with increased depth. As the trench was excavated to its final depth, it was filled with coarse rock spoil from one of the rock cuts on the new work. This rock presumably became so interlocked as to distribute any load upon it laterally as well as vertically in the peat bed, because no unusual settlement of the track under train operation has been noticed at this point since the work was completed.

The third place where one of the more unstable subgrade conditions was encountered was about a mile and one-half west of Denville where a widened roadbed was being provided for the two additional tracks through a 25-ft. cut on the south side of the old tracks. The difficulty at this point began in the cut where rock excavation ran out into earth excavation. As material was removed in making the earth cut, numerous evidences of springs were encountered, which transformed what appeared to be a fine, yet stable clay into a highly viscous material without supporting power. Adding to this unfavorable condition, a thin layer of what appeared to be quicklime was encountered, which had a horizontal outcrop in the cut, along which a continuous succession of slides took place.

When excavation had proceeded only to about one-half of the required depth, the soil became so saturated that it was necessary to block up the light excavating shovel constantly in order to keep it in operation. In spite of this blocking, the shovel settled so deep at times that it was feared that its operation would have to be discontinued. Eventually, however, the sloppy material in the cut was removed, and if it had not been for continued slides, it was thought that sufficient sub-drainage would have afforded a stable roadbed.

Was Known as "Mud Cut"

Not until the difficulties at this point were encountered was it understood why this location had long been known as "Mud Cut," and why the original roadbed was lined



A Stone Wall Stopped Sliding on the Unstable Slope

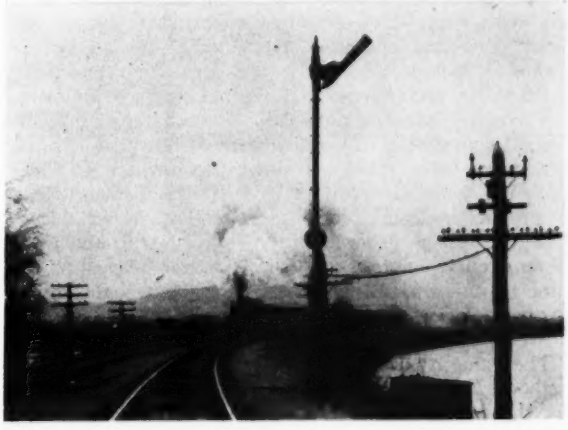
on both sides with stone walls. With the difficulty encountered in grading for the two additional tracks, it was evident that the stone walls were the means of stabilizing the roadbed, and therefore, after considerable grading had been done along the south side of the right of way to prevent slides in the cut, it was found neces-

sary to construct a stone wall along this side of the right of way to hold back the unstable material. This wall, which was built up of rock secured from excavation on another part of the work, was located about 15 ft. from the center line of the new outside track, and extended from a depth of about four feet below top of rail to about four feet above top of rail. The wall is four feet thick across the top, with a steep batter on the rear face, and is about 800 ft. long. It was backfilled with cinders. Since the completion of the wall, slides continued behind it until the earth is now apparently stable, level with the top. The fact that slides have not occurred

The Completed Work at "Mud Cut"

over the top of the wall is undoubtedly due to the fact that much of the water in the hillside is allowed to drain off through the wall to a 10-in. pipe installed in the sub-grade along the inside face of the wall. A similar drain was provided between the two new tracks with the idea of keeping surface water from the sub-grade. Using this type of construction, a stable roadbed has been secured, which requires no more than the usual amount of maintenance.

All of the grading work in connection with the new third and fourth tracks on the Lackawanna was done under contract, under the general direction of George J. Ray, chief engineer, and under the general supervision of M. H. Doughty, division engineer. A. H. Henckel, resident engineer, was in charge of the work in the field.



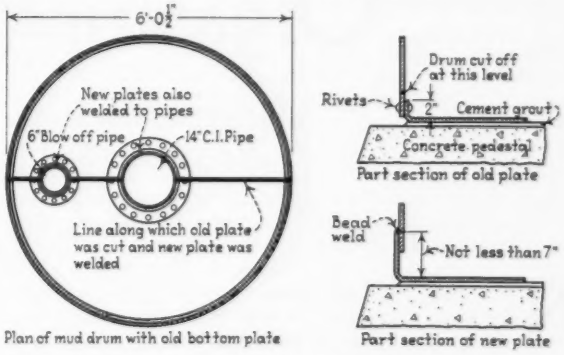
On the C. M. St. P. & P. near Winona, Minn.

Bottom of a Mud Drum Renewed by Welding

SERIOUS interference with the service of the only water tank at Stockton, Ill., on the Chicago Great Western recently during the renewal of the bottom plate of the mud drum was avoided by utilizing electric welding in such a manner that it was unnecessary to disturb or dismantle the drum or the piping that it contained.

This mud drum is 6 ft. ½ in. in diameter and is supported on a concrete foundation on which it had been bedded with a thin layer of cement grout. The bottom plate of the drum formerly had a 2-in. vertical flange that fitted inside of and was riveted to the shell of the drum. This plate was pierced by a 14-in. cast iron pipe and a 6-in. blow-off line that extended through it vertically. Some time ago it was observed that the bottom plate was cracked for practically the entire distance around the edge and the problem presented itself of renewing this plate without disturbing the two pipes. Removal of the pipes for the purpose of renewing the bottom plate would necessitate considerable time and expense and require that the water tank be taken out of service for some time, which was prohibitive.

It was decided to renew the bottom plate with one having a vertical flange around the edge not less than 7 in. high and fitting on the outside of the drum shell. The


6'-0½"
New plates also welded to pipes
6" Blow off pipe
14" C.I. Pipe
Line along which old plate was cut and new plate was welded
Plan of mud drum with old bottom plate
Drum cut off at this level
Rivets
2"
Cement grout
Concrete pedestal
Part section of old plate
Bead weld
Not less than 7"
Part section of new plate

A Plan of the Bottom of the Mud Drum and Sketches Showing the Manner in Which the New Bottom Plate was Installed.

old bottom plate was removed by cutting the shell of the drum just above the line of rivets that held the bottom plate to the drum and by cutting the plate on a line through the centers of the vertical pipes.

Removal of the pipes in the drum was avoided by installing the new plate in halves, the two sections joining on a line through the centers of the two pipes and having semi-circular openings to accommodate these pipes. The plates were placed by sliding them under the drum from opposite sides, which method of installation also solved the problem of equipping the mud drum with a bottom plate having a vertical flange reaching considerably higher than the bottom of the drum shell. The sections of the plate were then welded together at all joints and the top of the vertical flange was bead welded to the drum shell. Using this method, it required only 8½ hr. to cut away the old bottom plate and replace it with the new one.

We are indebted for the above information to N. Johnson, supervisor of bridges and buildings on the Great Western at St. Charles, Ill., who was in charge of the work.

Interior View of a Motor-Car Repair Shop

Organizing For Repair

Efficient maintenance of motor cars requires specially trained field and shop forces*†

By C. R. KNOWLES‡

NO group of track motor cars will prove more satisfactory than the maintenance that is accorded them. To insure proper maintenance methods it is necessary to establish a systematic organization.

The motor cars in service on the average railroad represent a large investment. In order to secure a proper return from this investment the cars must be kept in serviceable condition and properly operated. Good operation demands good maintenance; therefore, the measure of the return on an investment in motor cars is governed very largely by the manner in which they are maintained.

The placing of the maintenance of motor cars under a systematic organization does not always result in an additional expenditure for either equipment or labor for in many cases the desired results can be obtained by co-ordinating the efforts of existing organizations. To avoid a division of responsibility and lost motion, the operation and maintenance of motor cars should be concentrated under the general direction of one man. This will permit a closer check of their performance and control of the cost of repairs and operation, and assure the proper selection and assignment of cars, all of which are essential to economy in operation.

The man in charge of motor-car operation and maintenance should have sufficient mechanical knowledge and executive ability to supervise maintenance and direct operation. He should have full authority to establish and enforce the necessary regulations to gain the desired results.

The Organization

Where there are a sufficient number of motor cars in service, the work should justify the employment of a man whose sole duty would be the supervision of the maintenance and operation of the cars. It may be desirable to include also under the one organization the maintenance and operation of other work equipment, thus avoiding possible duplication of maintenance facilities and supervision. This arrangement has proved satisfactory on many roads. In other cases where an independent organization cannot be justified, the work may be assigned to some officer together with other duties. In any case, the general officer charged with the work of maintaining motor cars should report direct to the chief maintenance of way officer, as by far the larger proportion of the motor cars are used in the maintenance of way department.

The value of motor cars depends very largely on the methods followed in their maintenance and operation. For this reason the system superintendent of motor cars should have direct control of all mechanical details, of

*This is the fourteenth of a series of 15 articles on the care and operation of motor cars which have appeared consecutively, beginning with the January, 1930, issue, excepting the March, 1930 and 1931, issues. The concluding article will appear in the May issue.

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‡Mr. Knowles is in charge of the operation and maintenance of motor cars and other gasoline-operated work equipment on the Illinois Central System.

the supervision of motor car shops and of the maintainers, and should be responsible for correct individual and system reports. He should also, in conjunction with the purchasing and stores department and the departments using the cars, have a voice in the selection and purchase of new cars and supplies.

Headquarters should preferably be at the same location as those of the engineer maintenance of way or the chief system maintenance officer, as this will obviate unnecessary correspondence and expedite matters pertaining to the maintenance and operation of the equipment, as well as avoiding the necessity for maintaining duplicate files and records. The officer in charge of the maintenance of motor cars should be given such clerical assistance as may be necessary for the compilation of records of the cost of operation and maintenance of the cars.

The complete maintenance and supervisory organization required on an individual road will depend on a number of factors, among which are the number of cars in service, the number of different types, and the age and condition of the cars. Another important consideration is the manner in which the cars are operated, as it is obvious that careless operation of cars materially increases maintenance costs. As an approximate guide, it may be said that a road of 10,000 miles, fully equipped with motor cars, requires a superintendent of motor cars and two inspectors, while a railroad of only 2,000 miles can probably handle the work with one man.

The three organization charts shown are based upon the establishing of system, grand division or division shops. These charts are designed for railroads with a sufficient mileage to justify such organizations. It should be understood that on smaller lines with a limited number of cars, a smaller organization will suffice although in every case the maintenance and operation of motor cars should be centralized under one head. No hard and fast rule can be set up for a motor car maintenance organization as conditions vary with each road.

A Field Force

As pointed out in earlier articles in this series, the first responsibility for the care of a motor car rests with the operator. To supplement his work traveling repairmen may be employed to advantage under a systematic plan of motor-car maintenance. Their success depends, however, upon a complete understanding of their duties and the co-operation of all concerned, especially the motor-car operators. If the traveling repair men are called upon to make trivial repairs or adjustments that should be made by a competent motor-car operator, their usefulness is not only impaired but the cost of maintaining the cars is materially increased.

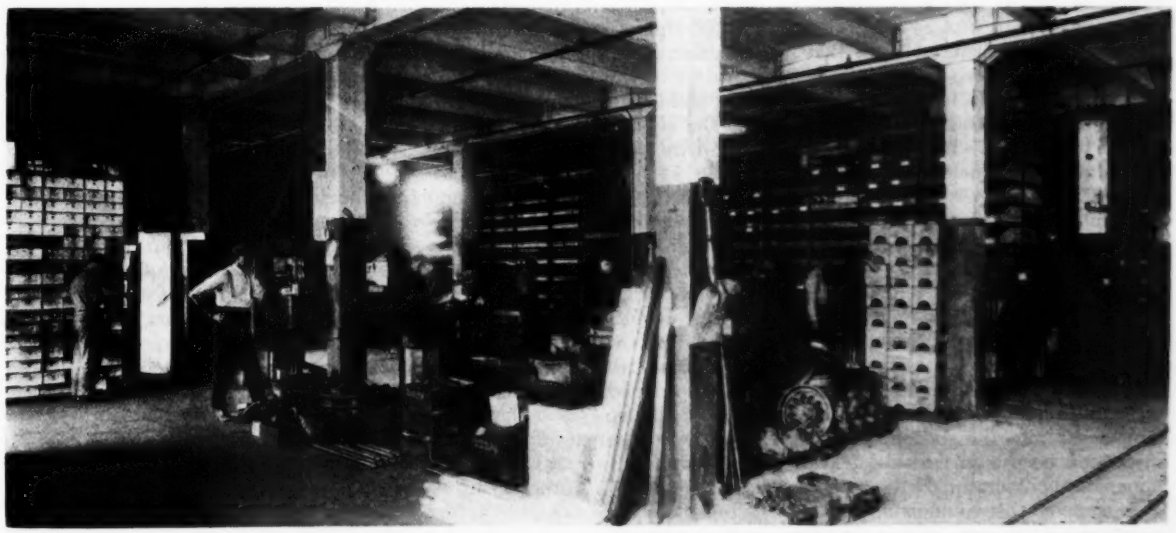
A Motor-Car Test Rack

Two Ford wheels below the floor are spun by the drive wheels of the car, and a prony brake on the axle below the floor registers the torque by means of an ordinary spring scale

The number of cars which may be handled by a field maintainer will vary with the conditions under which motor cars are operated and maintained. Under favorable conditions he should be able to handle the motor-car field maintenance work on a division of 500 miles with 150 to 175 cars.

A traveling repairman should be a skilled mechanic, thoroughly familiar with the maintenance of motor cars. In addition, he must also be resourceful as his tools and facilities for making field repairs will necessarily be limited. The selection of a man with the necessary qualifications for a field repairman is not always an easy matter.

An important part of the field repairman's work will



A Stock of Motor-Car Repair Parts in a Store Room

be the instruction of the operators of the motor cars in the proper operation and maintenance of their cars. It is also necessary that the field repairman check the operation of the cars, note the quality and amount of lubrication used, and observe the general manner in which the cars are operated. It will also be his duty to inspect cars regularly in the field and determine when they should be sent into the shop for repairs.

Motor-Car Shops

Such repairs to motor cars as are beyond the ability of the operator or the field maintainer can be performed more economically in shops equipped for the purpose. Where cars are operated by signal maintainers, water-service repairmen and others of similar mechanical training, light repairs, and in some cases more extensive repairs, can be made in the field by the operators, for as a rule these men have sufficient mechanical ability to take care of ordinary maintenance.

However, the average motor-car operator does not have sufficient mechanical ability or knowledge of the construction of a motor car to make field repairs. While it is highly desirable that light repairs and replacements of parts be made in the field, it is equally desirable that heavy repairs and general overhauling be done at points where the proper facilities are available for such work. The general tendency on the railroads is to centralize the maintenance of their motor cars. It is the present practice of most railroads to maintain division repair shops, although some of the large roads concentrate their motor-car repairs for the system in one or two shops.

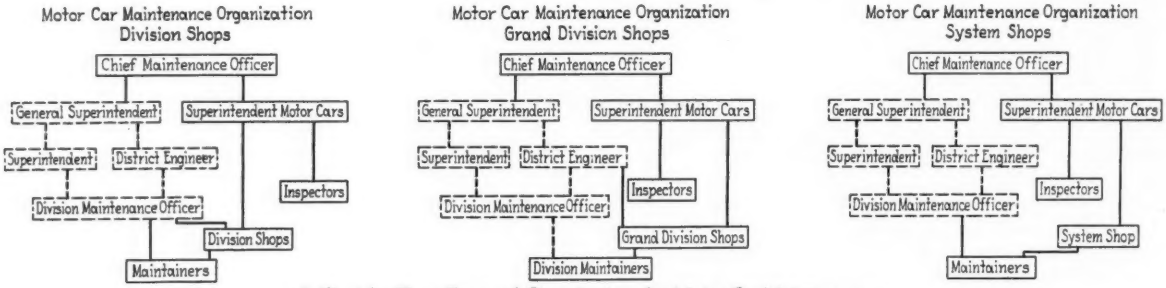
Among the advantages of a centrally located shop are the reduction in material stock that can be effected, the ability to utilize more efficient power tools and the saving that can be made in labor. Other advantages include the centralization of stocks of repair parts and the elimination of travel time which would be necessary if the work were done in the field.

The disadvantages include the increased distances that cars must be transported to and from the shop and the longer time that a car is out of service by reason of this longer travel. This latter objection can, however, be overcome by providing relief cars. These disadvantages are generally offset by more thorough and economical repairs. Furthermore, much of the time that the cars are out of service for repairs can be eliminated if the necessity for such repairs is anticipated and provision made for supplying the necessary materials prior to shipping a car into the shop. This can be done by proper inspection on the part of the traveling motor-car maintainer or the operator of the car.

A complete list of tools and appliances for the equipment of motor car shops was given in the thirteenth of this series of articles, in the February issue, page 141.

The most desirable method of driving power-operated machines is by electricity where electric current is available, as the expense for installing electric motors is usually less than any other type of drive. Furthermore, electricity is the most convenient form of power as it requires no attention and is available for use at all times by merely closing a switch or pressing a button. In the absence of electricity the most desirable source of power of driving tools and other machinery is an internal-combustion engine, either oil or gasoline. Where motor-car shops are located in connection with or adjacent to terminal power plants it is often possible to secure power from these facilities more economically than by establishing an individual power plant.

The problem of maintaining motor cars differs somewhat with each railroad, as the classes and variety of cars in service have a great deal to do with the methods of maintaining them and also with their general operation. For example, a large southern railroad is almost entirely equipped with one design of car, which makes it feasible to maintain all of the cars on the system in one central shop. Another railroad operating under similar conditions has 9 different makes and 22 different types of cars, thereby presenting a variety that increases the difficulty of centralizing repairs, particularly with respect to the furnishing of substitute cars.



A Chart for Three Types of Organizations for Motor-Car Maintenance

Another factor that tends to increase the cost of maintenance is the lack of uniformity of various types of cars, such as section cars. This is true of the different types of cars of the same make, as well as of those from different manufacturers. Perhaps the greatest improvement that could be made in promoting economy and efficiency of motor-car maintenance would be an effort on the part of the manufacturers toward the standardization of certain parts of the car, such as axles, carburetors, spark plug threads, hub lengths and bores, etc.

The Shop Force

It is commonly estimated that a shop motor-car maintainer should be employed for each 100 cars in service. This is a maximum figure, for in order to secure the satisfactory maintenance of this number of cars per man it is necessary to establish a retirement schedule which will permit of replacing cars before they have reached an age that requires excessive maintenance and also to establish such regulations as will insure careful, intelligent operation of the cars, thus avoiding their frequent and unnecessary shopping.

Each motor-car shop should be in charge of a foreman or lead repairman who will direct the work of the other men, keep their time and maintain such other records as are required. The number of mechanics required in the shop will depend upon the number of cars to be cared for, and whether traveling maintainers

are employed. System and grand division shops will usually employ a sufficient number of men to justify a foreman, while in division shops employing only two or three men the work should be directed by a working lead repairman who is paid a higher rate than the other shop mechanics.

The class of mechanic used will also vary according to the size of shop and force employed. In the larger shops there may be sufficient work to justify the employment of mechanics in the different trades, such as a machinist, a carpenter, a blacksmith, etc., while in the smaller shops the mechanics must be all-around men with a general knowledge of all classes of motor-car maintenance.

Most of the railroads have other work equipment in addition to motor cars. Where practical, the repair of this other equipment should be consolidated with the motor-car work under one organization and with the same forces.

Supplies and Repairs

The efficient and economical maintenance and operation of motor cars requires the stocking of an adequate supply of repair parts and other materials. The stocks of motor-car parts should be carried at centrally located storehouses under the jurisdiction of the stores department. The number of points at which these stocks should be carried will be governed largely by the mileage of the road and the location of the storehouses.

The centralization of motor-car parts at a limited number of storehouses reduces the investment in supplies by avoiding such duplication of stock as would prevail if separate stocks were carried at all the various storehouses. On one middle western railroad with 7,500 miles of lines and approximately 2,000 cars, the concentration of stocks of motor car parts in two storehouses has proved satisfactory. On another southern road with approximately 5,000 miles of lines and about 1,200 cars, one centrally located storehouse is maintained.

It is, of course, necessary to carry a certain amount of material at the repair shops for immediate use but these stocks should be limited to the actual requirements and surplus material forwarded to the central storehouse in order that it may be available for other points on the system. The character of most of the motor-car material and repair parts is such that they can be readily shipped by baggage, thus reducing the delay in delivering the material from a centrally located storehouse.

The recovery of useable parts from motor cars retired through damage or age is a feature of motor-car organization that deserves careful consideration. There are many parts of these retired cars that can be salvaged and used on other cars, for which the cost of recovery usually represents only a small part of their value.

The dismantling of retired motor cars should be carried out by or under the direct supervision of experienced motor-car mechanics, who are thoroughly familiar with the various types of cars in use. Care should be exercised to avoid carrying reclamation to excess, particularly as regards the reconditioning of relieved material. While the reclamation of useable parts can be carried out successfully where such parts are in good condition, the expense of repairing worn or broken parts can rarely if ever be justified.

Maintaining Records

The first essential to the effecting of economies in the operation and maintenance of motor cars is the establishing of uniform records of cost and performance of the cars. These records should, of course, begin with the operation of the car, who should be required to make out a monthly statement showing, in addition to the location and description of his car, the number of days the car was used, the miles run, the average number of men carried, the amount and cost of gasoline, and the amount and cost of lubricants and other supplies used. In addition, the statement should show the cost for maintenance, detailed as to labor and material. This information should be transmitted to the officer in charge of the maintenance and operation of the cars for tabulation and check.

Division Location

Kind of Car and Description R. R. Number Engine Number Date Purchased

Car Operated By Class of Service Price A. F. E.

PERIOD OF SERVICE			COST OF OPERATION					MAINTENANCE		
PERIOD	DAYS IN SERVICE	MILES RUN	GALLONS GASOLINE	COST	GALLONS LUBRICANTS	COST	MISCELLANEOUS	MATERIAL	LABOR	TOTAL
1930										
January										
February										
March										
April										
May										
June										
July										
August										
September										
October										
November										
December										
Total										

Fig. 1. Recapitulation of the Reports for an Individual Motor Car

Typical Forms

Figure 2 shows a typical form for motor-car operator's and maintainer's monthly report. Figure 1 is a recapitulation of reports for an individual car. The latter is compiled in the office of the superintendent or other officer in charge of motor cars from records furnished by the division officers.

It is estimated that the cost of keeping such a record represents an annual expense of approximately 50 cents per car but where such a system has been placed in effect, the expense has been fully justified. The maintaining of uniform records of motor cars not only indicates whether

the existing organization is operating efficiently but is essential also in determining the most economical type and make of motor car, and in indicating the economical limits to which expenditures may be made before retiring a car.

Simplification and Standardization

Much can be done to improve motor-car operation and maintenance through efforts toward standardization and simplification, both in the number and types of motor cars and in their design, particularly in regard to section and other cars in general use. The limiting of the purchase of cars to the smallest possible number of types can be controlled by the railroad. The standardization of parts and accessories is largely in the hands of the manufacturers.

MONTHLY REPORT OF MAINTENANCE & OPERATION OF MOTOR CARS

_____Division Month of _____192___

1. Number of Section or Gang___ Location _____

2. (a) Make & type of car _____ (b) Eng No _____ (c) ICRR No ____

3. Miles run this month _____ 4. Average no. of men carried ____

5. Total days used _____

6. Used for operation and maintaining cars this month:

	Amount	Cost		Amount	Cost
Gals of gasoline			Gals of Kerosene		
Gals of cylinder oil			Batteries rec'd		
Ft of belting rec'd			Spark plugs rec'd		
Lbs of cup grease rec'd			Canvass Covering		

7. Cost of labor repairing Car by Section Forces $_____

Remarks _____

8. Motor car repairmen's expense, Labor $ _____ Material $_____

9. To what extent are repairs made as result of an accident and from ordinary wear and tear? $_____

Correct:_____
Maintainer and Foreman

_____
Motor Car Repairman

Approved:_____
Supervisor

INSTRUCTIONS:

If car was not used at all during the month state reason under "Remarks."

The cost of all work done or material furnished cars by motor car repairman will be reported by him under Item 6 and need not be considered by motor car operator.

If any labor expense is incurred by Foreman and others repairing car, show it under question 7. This will not include motor car repairman's labor.

Fig. 2. Typical Form for Motor-Car Operator's and Maintainer's Monthly Report.

The American Railway Engineering Association is working toward the simplification and standardization of motor-car parts through its special committee on Maintenance of Way Work Equipment. Standards for wheel tread and flange, 16 and 20-in. wheels and wheel assembly were given in the fourth chapter of this series, May, 1930, issue, Pages 216 and 217.

This year's report of the American Railway Engineering Association included standard plans for couplers, safety railings and tool trays. Progress was also reported on standardization of other motor-car parts and accessories such as the size and type of bolts, types of gasoline lines, a flagging equipment box, rail sweeps, windshields, rail skids, etc.

Rules

The following rules have been drafted as representing good practice in motor-car maintenance:

(105) Wherever possible the work of maintaining motor cars should be consolidated with the maintenance of other work equipment.

(106) Light repairs to motor cars and replacements of parts should be made in the field, while heavy repairs and general overhauling should be done at centrally located shops where facilities are available for such work.

(107) As a general rule, the ratio of shop forces to motor cars should be one man for each 100 cars, while a field maintainer should take care of 150 to 175 cars.

(108) Motor-car shops and the maintenance of motor cars on each division should be under the supervision of a foreman or lead repairman reporting to and receiving instructions from the division engineer or such other officer as the division engineer may designate.

(109) The foreman or lead motor-car repairman should have immediate charge of mechanics, helpers, laborers and all other forces engaged in the maintenance of motor cars. He will keep such records regarding the cost of repairs to motor cars as the division engineer may direct and will make the required reports of work done and of the receipt, distribution and use of material.

(110) The foreman or lead motor-car repairman will have charge of and be responsible for the proper maintenance of all motor cars on his assigned territory.

(111) The foreman or lead repairman will have charge of or be responsible for such tools or materials as are necessary for the performance of this work and must know that these are properly used.

(112) Motor-car field repairmen will report to and receive instructions from the foreman or lead motor-car repairman, unless otherwise instructed by the division engineer.

(113) The field repairman will instruct the operators of motor cars as to their proper operation and field maintenance.

(114) The field repairmen will check the operation of the cars, the quality and amount of lubrication used, and the manner in which the cars are operated in general.

(115) The field repairmen must endeavor to know at all times the exact condition of all cars under their jurisdiction, making inspection of cars at every available opportunity.

(116) Field repairmen should determine when motor cars should be sent into the shop for repairs.

(117) Cars must not be shipped to the motor-car shop for repairs unless the repairs are of such nature that they cannot be performed as economically in the field.

(118) Accurate records of the performance of each motor car must be maintained.

On the Buffalo Rochester & Pittsburgh

Modernizing Timber Trestle Practices

Use of Creosoted wood in open-deck structures called for changes in design that would obviate mutilation of sticks in the field. The manner in which this problem was solved on the Burlington is presented in detail in this article.

By G. A. HAGGANDER
Bridge Engineer, Chicago, Burlington & Quincy

BEFORE the advent of creosoted material in pile-trestle bridge work, the design and methods of construction for this class of structures had changed but little over a long period of years. When creosoted material became available, considerable thought had to be given to designs which would eliminate the cutting of the material in the field, and methods of construction had to be modified somewhat to avoid unnecessary boring and cutting and breaking of the creosoted surface.

Early use was made of the creosoted ballasted-deck trestle with full-length stringers lapped on the caps. In this type of structure no cutting of the timber was necessary except the cutting off of the piles. The first structure of this type was built on the Burlington in 1905 and up to the present it has not been necessary to repair the deck of this bridge, the timber still being sound. Of the 40 piles, 8 have been replaced with posts, most of these having decayed at the top owing to a lack of appreciation at that time of the necessity for fully protecting all exposed surfaces with creosote.

Development of Creosoted Structures

For several reasons the application of creosoted material to open-deck trestles has been slow and of comparatively recent development. These reasons include the accompanying fire hazard, the reluctance to cut creosoted material, and the impression that creosoting reduces the strength of the timber, especially stringers.

These reasons are reflected in the slow development of this type of structure on the Burlington and other roads. Aside from a few scattered cases, the general use of treated piling was started in 1911 and the use of treated caps and sway braces followed in 1918, thus giving treated bents. In 1916, the use of treated ties and fenders was begun and in 1922 bulkhead material was treated. This left only the stringers untreated and after considerable hesitation, especially on account of the fire risk, the treatment of all stringers was adopted as standard in 1926.

The fire risk was reduced by the use of galvanized-iron as a covering for all decks. The reduction in the strength of the timber was not held to be detrimental, as further experience in the treatment of timber had developed methods that reduced this reduction in strength to a small percentage. It was felt that the strength of the treated timber would be retained over a long period of years, and at that time, would be higher than the strength of untreated timber which would then have deteriorated to a point where replacement was necessary.

The greatest remaining objection was to the cutting of stringers in the field to fit the various panel lengths. The design which had been used for many years on the Burlington, and which was not changed at the time that the use of creosoted stringers was adopted, consisted of five-pile bents with 14-in. by 14-in. by 14-ft. caps and 4-in. by 10-in. sway braces. For moderately heavy engines, the deck consisted of four lines of 8-in. by 16-in. by 14-ft. stringers with a 6-in. by 16-in. by 7-ft. packing block in each chord over the cap, 8-in. by 8-in. by 10-ft. ties, and 5-in. by 8-in. fenders.

The packing blocks were framed and treated before shipment. All lumber was purchased and sized to certain dimensions so that practically no sizing in the field was necessary. Occasionally there was a variation, due to a different rate of shrinkage, but this has been found to be negligible. The only cutting in the field on the open-deck trestle was, therefore, the piling and one end of the stringers.

Cutting of Stringers Eliminated

Cutting of the piling cannot be eliminated but the cutting of the ends of stringers in the field can. It is important to do this, as decay, starting at the cut end, will reduce the strength at the bearing where it is particularly important. Much thought was given to the elimination of cutting of the ends of the stringers in the field. With the old design of open-deck pile trestle, there were two possibilities.

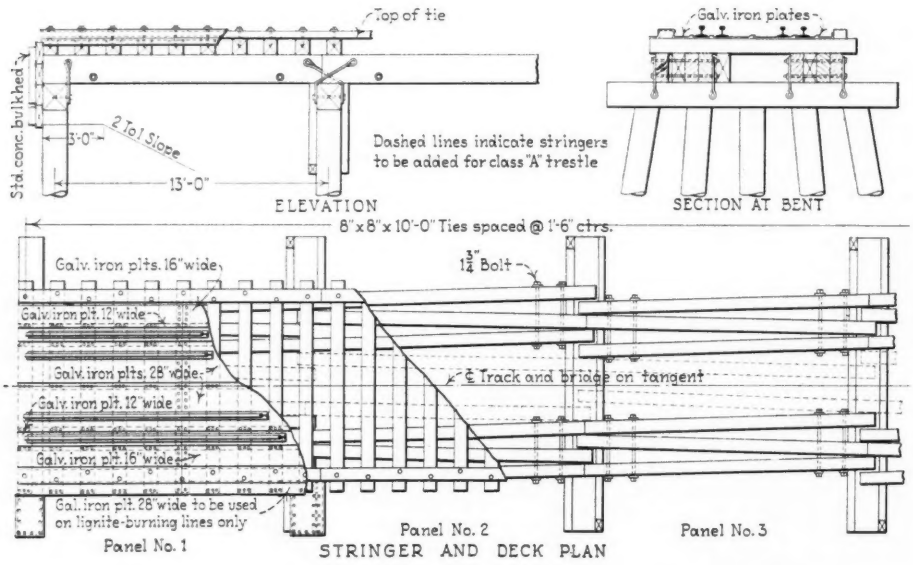
The first was to cut all stringers to a uniform length before treatment and then to drive the pile bents to exact spacing. This involves the cutting of all stringers before treatment at an additional cost and would necessarily increase the cost of driving piles and framing bents, owing to the accuracy required. While it might be possible to drive piles with such accuracy in some soils, it would be difficult where hard driving is encountered. Furthermore, if the piles are not driven in the exact position and the bent must be sprung into place, it is under strain and will probably pull the bridge out of line.

The second possibility was to drive and cap bents and

then measure the length of stringers required. They could then be cut to length before treatment. The difficulty connected with this plan is that a gang must go back to the bridge to place the deck, thus incurring extra moving expenses. The cost of cutting the stringers and the difficulty of sorting and marking the various lengths must also be considered.

In order to avoid the difficulties and expenses of cutting before treatment, which would be necessary under the old plan to avoid cutting stringers in the field, a new design was worked out. This involves the principles used in the creosoted ballasted-deck bridge, viz.; the lapping of the stringers on the cap. This principle is illustrated in the accompanying drawings.

The panel length was shortened from 14 ft. to 13 ft. 6 in. in order to give half the stringers a 13-in. bearing on the cap. In the new design, it is not necessary to cut the ends of any stringers excepting half of those in the end panels. An objection might be raised to the spread of the stringers, but careful calculations show that, with the size and spacing of ties used, the stress in the ties is not excessive and the distribution of load to the various stringers is satisfactory.


Top of tie
Galv. iron plates
Std. conc. bulkhead
3'-0"
2 To 1 Slope
13'-0"
Dashed lines indicate stringers to be added for class "A" trestle
ELEVATION
SECTION AT BENT
8"x8"x10'-0" Ties spaced @ 1'-6" ctrs.
Galv. iron plts. 16" wide
1¾" Bolt
Galv. iron plt. 12" wide
Galv. iron plts. 28" wide
℄ Track and bridge on tangent
Galv. iron plt. 12" wide
Galv. iron plt. 16" wide
Gal. iron plt. 28" wide to be used on lignite-burning lines only
Panel No. 1
Panel No. 2
Panel No. 3
STRINGER AND DECK PLAN

Showing the Deck and Stringer Plan of the Class B Trestle

This Method Now Standard

Several trestles of this design were built on the Burlington in 1929 on heavy grades and on lines carrying heavy traffic. Subsequent observation has shown that the decks have remained firmly anchored and that the trestles are satisfactory in other respects. Most of the trestles built on the Burlington in 1930 were of this type and it has been adopted as the standard. In the first design 8-in. channels were used as separator blocks between the stringers having the wide spacing. Experience has shown that these are unnecessary and they will, therefore, be eliminated in future work. The stringers will be allowed to bear against each other and the chord bolts will be pulled up tight.

The eye bolts are designed to prevent longitudinal movement of the stringers and provide anchorage against lateral forces or uplift due to flood water or drift. Extra horizontal bolts, through the caps, are desirable to prevent splitting of the caps, which is a common cause of failure in the old design. Some drift bolts have been used in the ends of the stringers, but these have proved unnecessary and will be eliminated in future work. In addition to eliminating the cutting of the stringers, this design has the advantage of giving a greater bearing area on the caps.

No preboring of the timber before treatment has yet been attempted, although this step is now being studied. It seems that the boring of drift bolt holes in the caps is entirely feasible, as the piling can be spaced properly after driving.

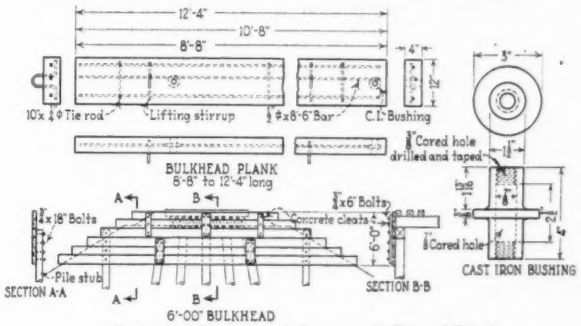
At the present time the tops of pile cut-offs are protected by painting them with hot creosote and covering them with heavy roofing paper before the cap is placed. Bored holes are poured full of hot creosote and a grease gun is used to force creosote into horizontal holes while the far end is temporarily plugged.

Single-panel stringers are used in these designs and have been used on all Burlington bridges for many years with satisfactory results. The first cost is less than double-panel stringers, they are easier to handle and place and replacement can be made more readily. The arguments commonly used against them are: (1) that the surface and line of trestles are more easily maintained with double-length stringers, although we have not observed this to be the case; and (2) that considerations of safety favor the double-length stringers as they might carry a train across a bridge if a bent were washed out or weakened. A case has never been known on the Burlington where this would have prevented a wreck and this road does not feel justified in spending money for the additional first cost, construction and maintenance of the double-panel stringers.

The fire risk involved in the case of open-deck pile-trestle bridges has not proved serious on the Burlington and there have been no fires in trestles of this type having creosoted stringers. This road has felt justified in changing its standards to the extent of putting galvanized iron coverings on bridges 100 ft. or over in length and on shorter bridges near curves which cannot be seen from an approaching train. Bridges which are not so covered have the exposed surfaces of timber where sparks might lodge painted with fire-resisting paint.

A recent development in timber trestles is the use of concrete-plank bulkheads. Their use was started in 1927, and they have been applied on all trestle bridges constructed since that year. The old practice was to use sec-

ond-hand untreated timber for bulkheads. In 1922 the use of second-hand treated timber was begun, as it was found that the untreated bulkheads had to be renewed at least once during the life of the balance of the structure. This disturbed the track at the ends of the bridges, where it is difficult to maintain proper surface, and was quite expensive. It was also found that the untreated bulkheads decayed at the ground line and were easily ignited.



Details of Reinforced Concrete Bulkhead Plank and a Typical Installation

The use of second-hand creosoted lumber was satisfactory, but on account of the many uses for second-hand bridge material it was thought advisable to look for a substitute, and concrete-plank bulkheads were adopted. These planks are manufactured at a central concrete plant and their cost in place is somewhat less than that of second-hand creosoted lumber. There is no fire hazard connected with the concrete planks and their use has resulted in releasing a large amount of second-hand material which is now available.

Methods of construction as applied to pile-trestle bridges have undergone considerable revision in recent years. Formerly piles were driven with drop-hammer drivers handled with work trains, while for a number of years the Burlington has used only steel self-propelled pile drivers with steam hammers. The use of this equipment has resulted in a tremendous saving in work-train service, as nine of these pile drivers now handle all pile driving on the system.

Treats Water Twice in New Plant

(Continued from page 363)

ing water storage tank, filter and appurtenances are painted with aluminum and the other machinery is painted green. Pipe lines are painted black with an aluminum trim and the floor of the machinery room is covered with a special buff floor paint. The chemical vat is covered and provided with a flue through the roof, which is topped with a rotary ventilator. An air jet is tapped into the flue and air is used to dispose of the chemical dust that is raised while the vat is being charged.

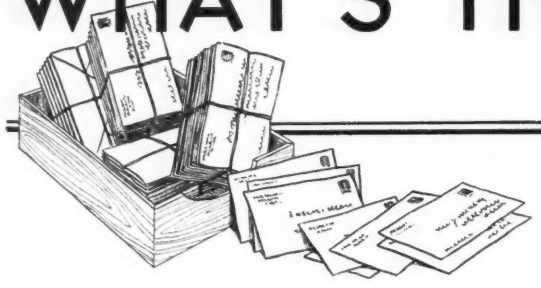
During the day, the plant is attended by one man, who also maintains the power plant and the boiler washing plant. This man was given a thorough course of instruction and takes care of the charging of the plant, in addition to making daily chemical tests and necessary adjustments to machinery. He works, of course, under the close supervision of the water engineer's force. During the night hours the power plant engineers attend to the operation of the plant. The machinery room is fitted with a complete chemical test cabinet under which is a sink with four bibcocks which deliver samples of water from the crane line and from a point half way up the tank.

The treating plant has now been in service for a year and during this time the hardness of the treated water has averaged less than 1.5 g.p.g., and the water has been free from turbidity. An average test is as follows: Soap hardness, 1.2 g.p.g; alkalinity to methyl orange, 5.0 g.p.g; and alkalinity to phenolphthalein, 3.0 g.p.g. Daily hardness and alkalinity tests are run on the drinking water and a weekly bacteriological examination is made. An average test of this water shows a hardness of 1.2 g.p.g., alkalinity to methyl orange, 3.6 g.p.g; and alkalinity to phenolphthalein, 1.1 g.p.g. A daily test is also run on the softened water for boiler use.

The plant was designed and erected under the supervision of J. H. Davidson, water engineer, and under the general direction of F. Ringer, chief engineer, while W. R. Anthony, assistant water engineer, was in charge of the field work. The steel tank was constructed by the Chicago Bridge & Iron Works, and all other work was done by railway forces. The chemical feeding and proportioning equipment was furnished by the Graver Corporation, East Chicago, Ind.

On the Delaware & Hudson, at Willow Rocks, Champlain Division

WHAT'S THE ANSWER?



Have you a question you would like to have someone answer? Have you an answer to any of the questions listed here?

To Be Answered in the June Issue

1. What are the relative advantages and disadvantages, from the standpoint of maintaining surface, of lock tamping and tamping the tie from both sides?

2. Where an old stone or concrete arch of moderate span shows indication of failure, what methods of repair, if any, can be employed to avoid renewal of the structure?

3. When spot surfacing, should the track be skeletonized before starting to make the raise? Why?

4. What causes the paint film to "wash" on wood and steel surfaces? What, if anything, can be done to prevent it?

5. What methods, if any, can be employed to eradicate Johnson grass?

6. What are the relative advantages and disadvantages of deep-well pumps and air lifts for wells having a depth of 80 to 100 ft?

7. When laying rail on multiple track lines, should the work be done with or against traffic? Why?

8. From the standpoint of maintenance, what are the relative advantages and disadvantages of the direct and indirect systems of heating engine pits?

Chalking of Paint

What is the cause of the chalking of the paint film on both wood and steel structures? How can it be remedied ?

Cause is Difficult to Determine

By E. C. NEVILLE
Bridge and Building Master, Canadian National, Toronto, Ont.

"Chalking" is a term that is used to describe the disintegration or separation of the surface of a paint film into the form of powder. This condition is observed frequently, but it is often difficult to determine the cause. It commonly presents itself where white lead has been applied to wood surfaces. It appears that white lead is more likely to chalk than other pigments, and that the reason for this probably is that the lead has not been allowed to mature a sufficient time to permit it to reach a waxy condition before it is used. In other words, it is in that state which painters call "short" because it is not elastic, but breaks easily from a paddle.

In other cases, chalking is caused by the destruction of the vehicle which holds the pigments together, through the use of too much turpentine or other dryers for mixing or thinning the paint. Moist sea air is said to contribute to chalking, particularly if the vehicle is linseed oil. Alternate exposure to extremes of climatic temperatures will start or accelerate the chalking process. In fact, any condition that tends to destroy the elasticity or bending qualities of the vehicle is conducive to chalking, on either wood or metal surfaces.

The use of a sufficient quantity of oil for mixing and thinning and of a minimum amount of dryer will help to avoid this trouble. Quite often the addition of a suitable amount of elastic varnish reduces the tendency to chalk. Chalking of the finishing coat on a new job of painting a wood surface can often be reduced to a minimum by careful attention to the details of the priming coat. This coat should contain sufficient oil to penetrate and fill the pores of the wood without "bleeding" the vehicle from the priming film.

For steel surfaces, permanent elasticity is essential for the durability of the paint. It should be able to expand and contract with the steel, consequently turpentine should not be used as a dryer, or, if used, it should be done with considerable caution. The same precautions are necessary on steel as on wood and, in addition, paint should never be applied to metal that is overheated by the summer sun, or the elasticity and binding qualities of the vehicle will be partly or wholly destroyed.

Chalking is Not a Defect

By Master Painter

Paint loses its gloss and chalks when the vehicle, generally linseed oil, is destroyed by such agencies as air, moisture or the actinic rays of the sun, or by a combination of one or more of these factors. It is not a true defect of paint, but merely a manifestation of the natural process of destruction which results from exposure to the elements.

Within certain limits, chalking is desirable, since a chalked surface affords the proper amount of "tooth" to give a tenacious bond with a subsequent coat of new paint, thus insuring complete adhesion between the old and new applications.

While the slow chalking which results from the natural corrosion—this term is used since the process simulates the corrosion of ferrous metals—of the vehicle cannot be avoided, premature, or accelerated, chalking is extremely undesirable. Where this occurs, it is almost certain that a poor quality of oil or an insufficient quantity of satisfactory vehicle has been used; again the same defect may be caused by the use of too much turpentine for drying.

There is no permanent remedy for chalking. Premature chalking can be avoided by using a sufficient amount of first quality linseed oil, or other satisfactory vehicle, and care in the application of the dryer. The process can be arrested by repainting the chalked surface with a paint that contains enough oil to satisfy the absorption requirements of the old surface film without itself becoming lean. Furthermore, heavy single-coat applications tend to accelerate the chalking process. To avoid this, it is better to apply the same thickness of film in two lighter coats.

It is Caused by an Excess of Dryer

By G. M. JOHNSON
Supervisor of Bridges and Buildings, Wabash, Peru, Ind.

Chalking of paint films results from the "deadening" of the paint vehicle or the "taking of the life out of it." The direct causes of this condition can usually be traced either to the use of an excess of turpentine as a dryer or to an excess of resin in the wood. In the first case, considerable improvement can be obtained by the addition of one of the zinc pigments. In the second case, the wood should be given a reasonably heavy coat of shellac before the paint is applied, or it can be painted with aluminum paint.

A third cause that is frequently observed is the use of paints that have been adulterated, either with naphtha for thinning or with whiting for filling.

Center Bound Track

What are the causes of center-bound track? How can it be prevented? Are the causes or methods of prevention different with different kinds of ballast ?

Several Causes Contribute

By W. H. CLEVELAND
General Track Inspector, Atchison, Topeka & Santa Fe, Wellington, Kan.

Several causes contribute to the development of center-bound track, particularly on heavy-traffic lines. While some of them are fundamental, the manner in which they manifest themselves varies with the kind and quality of the ballast and the condition of the subgrade. The manner in which the ballast has been prepared and placed, and the method of tamping are often important factors also in causing or preventing center-bound track.

When placing ballast on a new line, it is a serious error to put the track in service with a depth of ballast that is insufficient to distribute the superimposed loads uniformly over the subgrade. Otherwise, the ballast immediately under the ties will be crowded into the subgrade and, either relatively or actually, the soil of the subgrade rises into the cribs. Once this condition is established, no amount of superficial work will correct it, and it grows worse progressively. Soft spots appear, with the attendant evils, including center bound track, that accompany this condtion.

Assuming that the proper depth of ballast is to be installed, the track should be raised in two lifts, the first of which should bring the top of rail to approximately one inch below final surface. The ties should be well and uniformly tamped throughout their length and trains in sufficient number to compact the ballast thoroughly, should then be allowed to pass over the track. After the ballast has become well compacted by traffic, the final raise should be made. At this time the tamping should be done outside and for a distance of 16 in. inside of each rail, care being exercised to insure that no tie is tamped throughout its length. If the work is done properly, as described, center-bound track will not develop, but if the tamping is done over the full length of the tie during the final lift, center-bound track will develop in a short time.

When renewing ballast, the same methods should be followed. A heavy raise, in excess of 4 in., should be made in two lifts. If the raise is 4 in. or less, it should be made in one lift and the tamping should be done in the manner already described for the final lift of a new ballast installation.

A frequent cause of center-bound track is a narrow subgrade, or one in which the shoulder of the subgrade is not maintained to the proper height. Ballast containing too large a percentage of fine material, particularly if a large proportion of the fine material is confined in the cribs near the center of the track, is likely to give trouble, because track becomes center bound in a short time on ballast of this character. The ballast in the shoulder requires a sufficient amount of fine material acting as a binder to insure that it will pack solidly and not work out as a result of the movement of the tie under traffic.

The recent use of ties 8 ft. 6 in. long has reduced the tendency of the track to become center bound. It is often noticed, even on well maintained track, that for a space of 3 in. to 6 in. from the end, the ties do not have proper support from the ballast. The additional six inches in length, as compared with the former use of 8-ft. ties, aids materially in keeping a good support under the rail. It is fundamental that solid firm track cannot be maintained without adequate support, and that the tie is intended to act as a foundation for the rail and not as a beam to support it.

Kind of Ballast Has Some Influence

By Assistant District Engineer

Center-bound track results from several causes, the relative importance of which may be a matter of personal opinion or of local conditions. Tamping ties throughout their length and the later settlement of the track, as the ballast is compacted under traffic, probably cause the track to become center bound more quickly than any other single cause.

Another cause is a narrow subgrade, which does not provide sufficient support for the ballast section, allowing it to roll away from the ends of the ties. Poor drainage is a common cause, since it results in softening of the subgrade, which in the resulting plastic state allows the ballast near the ends of the ties to be forced down into the softened material, thus removing the support at the ends of the ties. Again, fine ballast that is foul is a fertile source of this same trouble, since, in wet weather, the fine material tends to wash out, while during very dry weather the movement of the tie forces it out. In either case, the end of the tie is left without proper support. Improper tamping is often a contributory cause, and in some cases may be a major cause.

The most successful method of prevention is to discard the foul or otherwise unsatisfactory ballast and replace it with clean material that will provide ample drainage, and then give the track a light general surface every two or three years. If this plan is followed, the center-bound track will be wholly eliminated or reduced to the point where it becomes a negligible problem.

In a measure, the kind of ballast has an influence on the

development of center-bound track. Track will become center bound more quickly and the trouble is more difficut to cure permanently in old cinders or foul ballast, particularly if the subgrade is narrow, than on clean coarse stone or slag which is supported on a wide subgrade where the shoulder is maintained to the proper height throughout the year.

Character of Ballast is Important

By J. J. HESS

General Roadmaster, Great Northern, Seattle, Wash.

In my opinion a principal cause of center-bound track is the use of ballast which does not provide satisfactory drainage because it is intermixed with soil or contains too large a percentage of sand. In either case, the ballast is foul when placed and this condition grows more aggravated with age. Ballast of this character must be dressed in such a manner that its surface is below the bottom of the ties at their ends; in other words, the ballast section must approximate that of dirt track in order to provide drainage, or the ties will churn and settle outside of and under the rail, so that this portion of the tie is not supported properly.

The remedy for a ballast and drainage condition similar to that described is to replace the unsatisfactory material with washed gravel, crushed stone, slag, cinders or even pit-run gravel, if it is of such a nature that it provides satisfactory drainage. But to make certain that the best results will be obtained, the subgrade must be properly established and thereafter maintained. The ballast section should extend 10 in. to 12 in. beyond the end of and be dressed level with the top of the ties. The slope from the ballast shoulder should be carefully maintained at 1½ : 1.

Having placed satisfactory ballast material as a foundition for the track, the important element in eliminating center-bound track is to avoid tamping the ties at or near the center. A thorough job of tamping should be done at the ends and for approximately one foot inside the rail. If this practice is adhered to, center-bound track will be the least of the maintenance man's troubles.

Keep the Ends of the Ties Supported

By E. L. BANION

Roadmaster, Atchison, Topeka & Santa Fe, Independence, Kan.

Center-bound track usually has one cause that is common to every case, although there are generally other causes that contribute, depending on the kind of ballast or on local conditions. This common cause is the tendency of the ballast to settle and compact under traffic. Since the major part of the traffic loads are applied toward the ends of the ties, the greatest amount of compression occurs at these points. Furthermore, in the process of compression there is a slight tendency on the part of the ballast to crowd out or flow laterally. Since the ballast near the center of the tie is more confined, the crowding action here is a minimum, but increases toward the ends of the tie, so that the center remains well supported, while the support becomes less effective at the ends.

When this action has progressed sufficiently, the train gets an uncomfortable rocking motion as it passes over the track. Carried to an extreme, many cases have occurred in which ties have broken at the center because they were unable to act as beams to support the traffic loads.

The remedy is indicated by the cause. The ties should be tamped at their ends and for about 16 in. inside the rail, but never at the center. Ballast, particularly crushed stone, should never be allowed to become foul, since it will puddle and churn in wet weather and pound out in dust during dry weather, both conditions resulting in center-bound track, which only out-of-face surfacing will cure effectively.

Center Tamping Often is Cause

By R. T. DORSEY

Section Foreman, Louisville & Nashville, Louisville, Ky.

It is my observation that two causes are principally responsible for center-bound track. The first is the practice of many trackmen of tamping ties throughout their length. When surfacing track, particularly in rock ballast, the tamping should be done under the rail and out to the ends of the ties. After a few trains have passed, the occasional weak places should be picked up and the ties should be well tamped for about 18 in. inside of the rails. The remainder of the distance at and near the center should be filled without tamping. The second cause may be either a narrow ballast shoulder or a narrow or low subgrade section. In either case, the ballast near the ends of the ties does not receive sufficient lateral support and is crowded out, leaving the ties loose at the ends.

Narrow Subgrade is Principal Cause

By H. BECKER

Section Foreman, St. Louis-San Francisco, Rush Tower, Mo.

Narrow or low shoulders on the subgrade are the principal cause of much of the center-bound track that is found on almost any railway, particularly those that do not have high standards of maintenance. Where the subgrade is narrow or low, the shoulder of the ballast is not supported properly, with the result that it is crowded out from the ends of the ties, causing them to become loose, while the ballast inside the rail is affected little if any, so that the tie is supported only at the center and for a short distance on either side. Furthermore, ballast containing a large proportion of fine material induces center-bound track much quicker than coarse ballast, particularly in dry weather.

The surest remedy for center-bound track is, therefore, to maintain the subgrade to full width and height. If this is done and the ties are invariably tamped outside of and for about 16 in. inside of each rail, the center-bound condition will, to a large extent, be eliminated.

Care in Construction is Necessary

By G. STAFFORD

Section Foreman, Canadian National, Rosebud, Alta.

In its severest form, center-bound track is almost invariably the result of a moisture-saturated subgrade. This instability of the subgrade may result, in turn, from a variety of causes including improper finishing of the crown; the use of unstable material in the construction of the roadbed; inadequate drainage in cuts; too light an original installation of ballast; and occasionally the use of impervious material for the shoulder and outer portion of the subgrade. All of these defects rest finally on improper drainage or distortion of the roadbed through errors of construction and the only remedy is the subsequent installation of an efficient system of subdrainage.

Center-bound track often develops, though in lesser degree, from careless tamping, from leaving the cribs open after tamping or from inferior ballast. The latter includes gravel that has a high percentage of stones larger in size than two inches. Provided general maintenance is

good, none of these causes is serious, since the center-bound condition can easily be corrected by careful work. It does not develop quickly, so that the section forces have timely warning of its approach and can overcome it by light surfacing.

In general, the character of the ballast is negligible as a cause of center-bound track in its severest and most troublesome form. To prevent this condition, care must be used in constructing the roadbed. Every unseasoned subgrade should first receive a layer of gravel, locomotive cinders or chatts, on top of which the ballast should be placed to a minimum depth of 12 in. Two lifts should be made in this ballast, the first to within 1½ or 2 in. of the final surface. After traffic has compacted the ballast, the final raise should be made, tamping the ties at the ends and for 16 in. inside the rail.

Safety at Crossings

What measures can section forces adopt to increase safety at highway crossings ?

Operate Motor Cars Carefully

By Assistant District Engineer

While there are many things that the section forces can do to increase safety at highway crossings, I will mention only one. In my opinion, the most important thing in this respect is the careful operation of track motor cars. The most stringent safety measures should be observed while approaching and passing over all crossings, but particularly those where the traffic is heavy or where physical conditions make them unusually hazardous.

All track motor cars should be equipped with some form of audible warning signal which should be sounded vigorously as the car approaches the crossing, and this approach should be at low speed, even though there are no vehicles or foot passengers in sight. If necessary, the car should be stopped and a man sent ahead to flag the crossing until the motor car has passed. Such action will eliminate all probability of accident and relieve the foreman of responsibility for the death or serious injury of innocent persons.

Numerous Items Must Be Cared For

By C. F. WOMELDORF

Division Engineer, Chicago & North Western, Norfolk, Neb.

Section forces are saddled with many responsibilities, among them certain items in relation to highway crossings. Among the things that they can do to increase safety at these crossings, I would like to emphasize the following:

1. Crossing warning signs should be located with special reference to their visibility from the highway. Wing fences should be maintained in first-class condition and kept well whitewashed.

2. The view of the track from the highway should be unobstructed. This requires the elimination of trees, brush or tall vegetation for some distance back of the crossing. In some cases, it may be necessary to secure the consent of adjacent property owners to the removal of these obstructions. Bill boards and other outdoor advertising structures and signs should not be permitted near the crossing approaches. Some states have laws regulating the cutting of brush and the location of advertising signs, and foremen should be familiar with these laws.

3. Except in emergencies, motor cars should never be set off at highway crossings.

4. Section forces working near crossings serving heavy highway traffic should flag such crossings as trains approach.

5. Flagmen should be stationed at crossings protected by automatic warning devices, in the event of the failure of such devices, until they are repaired.

6. Flangeways should be kept clean at all times, and snow, rubbish, ice or other materials removed from the crossing and flangeways should be deposited beyond the limits of the crossing approaches.

7. The crossing surface should be kept smooth, in good repair, and to the proper width at all times.

8. Foremen should keep in touch with highway maintainers, particularly where it is the practice to drag the roads, and insist that they clean the flangeways and remove other material from the crossing, which is left by the drag.

9. They should also maintain similar contact with contractors or others who are hauling quantities of material over a crossing, and insist that they take similar action to keep the track and flangeways clean. If this is not practicable a man should be assigned from the gang to maintain safe conditions while the hauling is in progress.

10. Crossings located on steep hillsides or at the foot of steep highway grades should be given prompt and careful attention during and following rainstorms to prevent the deposit of mud, sand or gravel on the track and in the flangeways. When possible, drainage should be diverted before reaching the track.

11. Certain states have laws requiring drivers of motor vehicles to stop and look carefully in both directions before proceeding over railway crossings. Where such laws are in effect, section forces should report all violations that come to their attention.

Good Maintenance Covers all Requirements

By R. H. GILKEY

Division Engineer, Central of Georgia, Savannah, Ga.

Good crossing maintenance should be understood to cover all safety requirements, so far as physical conditions are concerned, and I interpret the question as referring primarily to physical conditions. Section forces should make certain that the surface of the crossing itself is smooth, is in good condition and has ample width to accommodate the traffic that it serves. The flangeways should be kept clean and all planks, if it be a planked crossing, should be nailed securely.

The approaches should be maintained level, or nearly so, for at least 50 ft. beyond the outside tracks. The approach grade should be made as easy as conditions justify, to insure that motor vehicles can be easily controlled and will not stall as they approach the tracks. The approaches should be of ample width to avoid any interference between traffic moving in opposite directions. If they are in a cut, the width should be sufficient to care for all necessary drainage.

All trees, shrubbery, tall vegetation and other obstructions should be removed to give a clear view of the tracks in both directions. Standard crossing-warning signs should be so located as to be easily visible from the highway and all lettering should be clear and distinct. The standard whistling posts should be in correct position along the tracks, the lettering should be sharp and clear, and they should not be obstructed by vegetation or other

structures. In other words, good maintenance includes a smooth safe crossing surface, satisfactory approaches, an unobstructed view of the tracks from the highway and adequate fixed warning signs.

View Should Be Kept Clear

By H. BECKER

Section Foreman, St. Louis-San Francisco, Rush Tower, Mo.

To mention all of the things that the section forces can do to promote safety at highway crossings would require too long a recital of details. Among the important items, however, an unobstructed view of the tracks from the highway takes first rank. Of equal importance, the gradient of approaches should be such that they present no obstruction to the free movement of vehicles. Steep or narrow approaches to highway crossing are, to put it mildly, a grave nuisance, even if they occur on unimportant highways. They also are a decided menace to the safety of the traffic using the crossing, and the section foreman who has such approaches is certainly remiss in his duties and does not take a broad view of safety rules.

The crossing surface should be maintained so that it will be smooth at all times and of sufficient width to accommodate the traffic. The usual tendency is to maintain wide crossings on important highways and reduce the width below what it should be on those that are less heavily traveled.

The section forces can do much valuable missionary work in the nature of accident prevention by discussing the proper procedure in approaching and crossing railway tracks with their acquaintances, and even with strangers, when opportunity offers. On their own part, extreme care should be exercised in the operation of track motor cars over highway crossings.

Constant Attention is Necessary

By ROBERT WHITE

Section Foreman, Grand Trunk Western, Drayton Plains, Mich.

An important item in the promotion of safety at highway crossings is to have an unobstructed view of the tracks in both directions from the highway. For this reason, all bushes, high weeds and, often, trees should be cut. The approaches should be of ample width, and the removal of the weeds should include those on the shoulders of the approaches and in the ditches, so that the limits of the roadway will be sharply defined.

The roadway surface should be smooth. If the crossing is planked, the planks should be secured firmly in place, and should be beveled on both ends to avoid catching dragging parts from passing cars. Special attention should be given to the crossing planks in winter to insure that they are not being heaved or loosened as a result of the packing of snow under them by the wheel flanges.

When repairing a crossing, the foreman, or a man specially assigned from the gang should direct traffic around the obstruction. Never take a motor car off at a crossing if it can be avoided. If necessary to do so, set it back far enough so that it will not interfere with the passage of vehicles. When cleaning a crossing, bury any large stones that may be in the vicinity, for if they are rolled on the crossing they may be broken by trains and the flying splinters may cause injuries to persons or vehicles. When cleaning snow or ice from a crossing, do not pile it near the crossing, but keep it well back from the roadway and tracks. The crossing surface and the highway surface for some distance away from the tracks should be completely cleaned of snow so that the crossing and highway will be well defined.

A type of accident that is largely preventable is that of derailments caused by obstructions on the rail or in crossing flangeways. These are frequently caused by children placing bolts, nuts, spikes or other scrap on top of the rail to see the train run over them. For this reason, special effort should be directed toward cleaning up all scrap and unused materials around crossings.

Not infrequently, section men working around crossings signal cars to "come ahead." This should never be permitted unless the man is definitely assigned to flag the crossing and then he should be provided with the proper flagging equipment.

Protecting Cinder Pits

What is the most practical method of protecting deep-water cinder pits to prevent hostlers and others from falling into them ?

Gates Offer a Simple Means of Protection

By Division Engineer

When we placed our first deep-water cinder pits in service, several of the men in the maintenance of way department walked over the ends and fell into the water. Although there were no serious consequences from these accidents, as the men were easily rescued, the possibility of a drowning was always present. We therefore installed pipe railings between the tracks at each end of the pits.

This expedient did not have the desired effect, however, since, for some reason, in several instances, men walked down the center of the engine track and, taking the scum that usually collects at the ends of these pits for solid ground, fell in. We then erected swinging gates with flexible gate arms across the tracks. They were arranged to swing in either direction and were fitted with springs which returned them to position automatically after they were opened for the passage of the locomotives. After they were erected, there were no further accidents.

Covers Offer Only Sure Protection

By Engineer of Buildings

In the early days of the use of deep-water cinder pits, we had several serious accidents as a result of men climbing off of engines while the fires were being cleaned. In one case, a conductor, whose crew was pulling the ash track, stepped from his caboose into the cinder pit and was seriously burned and scalded before he could be rescued.

As a result of these accidents we made a study to determine the best form of protection, and finally decided to use an open-grate cover which could be easily removed and replaced by the gantry crane that was used for loading the cinders. This cover was made up in 4-ft. sections, each of which spanned the width of the pit from the inner rail to the inner pit wall. Each section was supported at one end by the box girder which carried the rail between supporting columns, while the other end rested on the inner wall of the pit.

When necessary to load out the cinders, two or more of the sections are lifted out of the way and are then replaced as soon as the loading from this section of the pit is completed. This scheme has been effective in

eliminating the type of accidents for which it was designed. It has the merit of costing a relatively small amount, while maintenance is nearly negligible, and its use does not noticeably retard the work of loading.

Renewing Ties

What are the relative advantages and disadvantages of the spot and out-of-face methods of renewing ties ?

Depends on Tie Condition

By H. BECKER

Section Foreman, St. Louis-San Francisco, Rush Tower, Mo.

In my opinion the method that can be followed to best advantage will depend on the number of ties that require renewal and their distribution over a given section of track. If only an occasional tie, say one or two to a rail, is required, the spotting method can be used to advantage. On the other hand, if a large number of ties must be renewed, there is a decided advantage in giving the track a general raise of two or three inches and renewing all ties that will not last more than two years.

So far as I have observed, it is my opinion that where track requires heavy tie renewals, the out-of-face method costs less, since it is not necessary to disturb the old bed if a sufficient raise is made. Furthermore by removing all ties that will not last more than two years, it will not be necessary to disturb the track for tie renewals the following year, so that the loss in the value of the extra ties removed at this time is more than made up in the reduced cost of track maintenance during the next year.

Both Methods Have Advantages

By Assistant District Engineer

Each of the methods mentioned has certain advantages and also certain disadvantages. At times one method may be strongly indicated, while other conditions may as easily justify the other method. I am not an advocate of either method, but believe each should be used as economy or good maintenance will be served best.

Some of the advantages of the spot method are: (1) There may be a saving in the number of ties that are required, since new ties can often be installed on either side of a tie that still has a good bearing for the rail, but is otherwise unfit to remain in service, thus permitting another year of service to be obtained from this tie. (2) The roadbed is not disturbed so much, thus leaving the track in better riding condition. (3) Tie renewals can be completed earlier, leaving more time for general maintenance. (4) Tie rotation ultimately becomes more uniform, and (5) The plan often permits a reduction in the section forces.

Some of the disadvantages of this method are: (1) The cost of renewal per tie is usually higher. (2) If this method is carried to an extreme, the track is not surfaced out of face often enough, with the result that the ballast may become foul or the track may become center bound. (3) The bearing eventually lacks uniformity, resulting in broken or surface-bent rails.

On the other hand, the out-of-face method has definite advantages. Where this method is used, it is the usual custom to renew the ties over only a part of the section each year. For this reason, the part selected for tie renewals in any year (1) is commonly given a general raise of approximately two inches, with the result that (2) more ties are installed in a given time, and at a less cost per tie; (3) the physical condition and riding qualities of the track generally remain better during the period between tie renewals than they do under the practice of spotting renewals.

This method has a number of disadvantages, however, which must be weighed against its obvious advantages. (1) Ties are often removed from the track before their normal service life is completed. The common excuse for doing this it that it is better to remove these ties than to disturb the track before the out-of-face renewals are again undertaken. (2) There is an additional expense connected with the out-of-face surfacing of the track and the application of the ballast, which is necessary under this method. (3) A certain amount of surfacing is necessary, following the tie renewals, for the purpose of picking up and lining weak places which invariably develop. (4) Ordinarily three or four periods of overhauling are required to stabilize the cycle of renewal. (5) Less time is available for general maintenance.

Suction Intakes

What precautions, if any, can be taken to insure that a suction line taking water from a stream will function properly during spring freshets ?

Should Be Angled With the Stream

By G. M. JOHNSON

Supervisor of Bridges and Building, Wabash, Peru, Ind.

Suction lines laid in streams that are subject to wide variations of flow or that carry much sediment or drift during freshets, should be laid so as to point down stream at an angle with the direction of the current. They should be provided with a swivel joint far enough back from the end to permit workmen to raise the foot valve above high water for cleaning. A chain or rope should be attached to the pipe and anchored to a float, to give ready access to the movable section of the pipe. Conditions can often be improved by the construction of a dike or breakwater to divert the drift, ice and heavy sediment away from the end of the pipe.

Depends on Character of Stream

By Engineer of Water Service

Before plans can be made for the proper maintenance of a suction line which must function under the conditions laid down in the question, the sources from which the stream receives its water and the character of the drift and suspended matter which it carries must be investigated. Trouble from suspended matter, such as mud, sand, gravel, etc., can often be avoided by the construction of a settling basin, the installation of a swinging pipe, or the erection of a dike or deflecting wall to prevent the formation of a bar over the intake end of the pipe.

Floating material, when present in quantity, particularly fish, leaves and small twigs or other vegetable debris, always presents a more serious problem than the heavier suspended matter. The only remedy for these floating materials is the use of a strainer. The placing of strainers on the ends of suction lines is not always effective, however, since they often become completely choked up by the debris. Where this condition occurs, the suction line should be laid in such manner that the end can be lifted

and the strainer cleaned. It is often imperative that the screen be so designed that it consists of two independent compartments, either of which can be cleaned without disturbing the other or necessitating the closing of the pumps.

Settling basins are effective but are often quite expensive. Where conditions require their use, they should be constructed so as to consist of two compartments separated by a screen of large area. The water enters the first compartment where the velocity is reduced to such an extent that the heavy sediment is deposited. The rate of flow through the screen is also reduced so that it is not choked by the floating debris, much of which will settle with the suspended matter in the outer compartment. A sump of this type, which was located on a small southern river which carried an excessive amount of leaves, twigs and other vegetable debris, was in service, completely submerged, for nearly a year. When cleaned, the outer or stilling compartment was filled to a depth of nearly 4 ft. and contained 8 cu. yd. of intermixed mud, sand, leaves, twigs and hickory nut hulls and shells. The inner compartment had a deposit of finer material only about 10 in. deep.

If the bed of the stream is composed of coarse gravel with little silt or mud, good results can often be obtained from attaching a well screen to the end of the suction line and burying it in the bed of the stream.

In general, intake sumps, multiple screens and similar devices are so expensive that they cannot be justified, except for the more important water stations. For this reason, at many stations the suction pipe is passed directly into the stream. Where this is done the pipe should have a swinging joint so that it can be lifted and cleaned. If the stream carries an excessive amount of floating debris, arrangements should be made to turn water from the service tank back into the suction line for the purpose of washing the screen.

Sump Insures Dependable Supply

By R. H. GILKEY

Division Engineer, Central of Georgia, Savannah, Ga.

If suction lines are to function to best advantage during spring freshets, it is desirable to install the intake end of the pipe in a well or sump and connect this with the main source of supply by means of a larger pipe or pipes. The latter should be fitted with a strainer at the outer end and it should have a gate valve placed inside the sump to cut off the flow in case the foot valve of the suction pipe needs repairs or cleaning. This method insures a dependable supply in the sump at all times.

Should Be Firmly Anchored

By Assistant District Engineer

In the first place, a suction line such as is assumed in the question should be anchored securely so that there will be no probability that it will be destroyed by drift. If an intake crib or well has been constructed in the stream, it should be protected by a breakwater which will deflect driftwood and ice. The curbing should be tight from about one foot below the bed of the stream to a point above high water. If the stream has a gravel bed, this will act as a filter, so that no intake opening will be required, and the water will be reasonably clear, even in streams that carry heavy silt during flood stages.

Wells of this character are superior to the open crib or the practice of running an unprotected suction pipe out into the stream. In general, it can be constructed on or near the shore so that it is easy of access and does not obstruct the flow. The location will vary, however, depending on local conditions and the judgment of the water-service officers.

Scouring Below Culverts

What means can be employed to eliminate or minimize scouring below the outlets of culverts located along steep side hills ?

Obstructions to Flow Are Effective

By Assistant District Engineer

An effective method of minimizing scour below the outlets of culverts is to install a fan-shaped concrete apron which permits the water to spread out, thus reducing its velocity and its erosive action. Another method is to place a generous quantity of one or two-men riprap at the outlet. Still another method is to substitute rolls of scrap fence wire for the riprap. Old ties laid so as to form dams and terraces are often very effective. Another method is to plant them on end at frequent intervals, staggering them in the channel so as to offer maximum obstruction to the flow.

Properly placed, obstructions permit the accumulation of soil, if the hillside is not too steep, in which brush and other vegetation can get a foothold. A good growth of brush, preferably willows, tends to minimize scour.

Riprap Eliminates This Trouble

By R. H. GILKEY

Division Engineer, Central of Georgia, Savannah, Ga.

It has been our experience that the most successful method of combatting the troublesome scour which so frequently occurs below culverts which are located along steep side hills, is to construct a trough or channel of riprap. To do this a smooth trench about three feet wide and three feet deep is first constructed. The bottom and sides are then lined with riprap, carefully laid to a reasonably close fit. Finally all openings that remain between the stones are filled with a rich grout made in the proportions of 1 part cement to 2 parts sand. If riprap is not readily available or conditions are not favorable for its use, a flume of creosoted lumber is often quite effective in curing the condition.

Seasonal Preparation

After the frost is out of the ground and the track has settled, how long a period should be allowed for smoothing the line and surface before starting the season's program? What details of track maintenance should be given particular attention at this time ?

Smoothing is Important Part of Program

By Engineer Maintenance of Way

Many track supervisors are so impatient to get started on their season's program of tie renewals that they do not allow their foreman sufficient time to do a satisfactory job of smoothing the line and surface before they start renewing ties. The result is that at a later date the tie program must be interrupted to line and surface sections

of track that have caused adverse criticism. Such places often require the application of many more man-hours at this time than would have been required if the work had been done at the proper time.

I have in mind two supervisors who were working under almost exactly similar physical and traffic conditions. One always insisted on his foremen doing a first class job of smoothing before the tie renewals were started. The other, in his impatience to get his ties in early, permitted his foremen to do only a minimum amount of smoothing before they started this work. The result was that the first supervisor was always commended for his good track and, furthermore, he usually finished with his ties before the other did.

The second supervisor received constant criticism for having rough track and was compelled to stop his tie renewals at frequent intervals to line and surface here and there on his sections, with the result that he usually completed his tie program later than the supervisor who maintained good-riding track by putting it in condition before undertaking the heavy part of his summer work.

Smoothing Saves Later Interruptions

By V. H. SHORE

Yard Foreman, Atchison, Topeka & Santa Fe, Dodge City, Kan.

It is important that work on the season's program shall start as soon as the frost is out of the ground and the track has settled so that surfacing is practicable. However, even the best-maintained track should be smoothed before tie renewals or other heavy maintenance work is started, so that it will not be necessary later to interrupt it for the purpose of keeping the track in good-riding condition. The worst places should be smoothed first, and after this the gang should start at one end of the section, tightening bolts and other fastenings, smoothing the line and surface, renewing ties, opening waterways and straighteing the ballast toe line.

Every effort should be made to get over as much of the section as possible by June 1, especially if the right of way is to be mowed by hand. Where machines are used for mowing, the track forces can do more and better work because interruptions are largely eliminated. No matter how carefully the initial smoothing is done, it is the experience on most sections that rough places will develop from time to time during the season, and these should be taken care of promptly as they occur. Neglect of this important feature of maintenance at any time is certain to result in a large amount of rough track with the consequent necessity of a greater amount of heavy surfacing and lining later in the season.

Depends on Many Local Conditions

By Supervisor of Track

Track conditions in the spring are influenced by several factors which must be considered before the question can be answered definitely. In the first place, the amount and character of the ballast is important. In most cases the condition of the track as it entered the winter is equally important, and this depends on the standard of maintenance during the previous year.

Assuming, however, that the ballast is satisfactory in character and quantity and that the track has been well maintained, the time that should be given to this form of preparatory work will vary from two weeks to a month, depending to some extent on the amount of traffic, the severity of the winter and the amount of rain during the spring. Often a section that is ballasted with gravel will require more time to smooth than one ballasted with crushed stone. The important thing, however, is to get the track into smooth riding condition before the tie program starts, regardless of the time it takes.

An alert foreman will already have tightened his bolts so that he will not need to spend any time on this feature during the smoothing period. He should drive down spikes and shift occasional anti-creepers to fit snugly against ties. If drainage has been properly cared for, as it should be, he will need to give this little or no attention. Loose or damaged planks in private crossings should be taken care of and other minor items cared for so that he will not have to break into his schedule later to attend to them. Particularly bad spots should be given attention first, then the foreman should start at one end of his section and level and line his track progressively till he reaches the other end. If the line is double-tracked, he should complete one track and double back on the other.

Lump or Hydrated Lime

From the standpoint of operation, what are the advantages and disadvantages of using lump lime as compared with hydrated lime at water-treating plants ?

A further answer to this question, which was discussed in the March issue.

Hydrated Lime Is More Advantageous

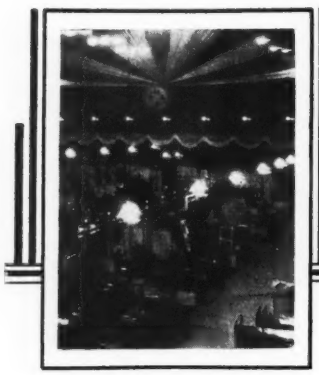
By Supervisor of Water Service

From the standpoint of operation, hydrated lime possesses many advantages over lump lime, among which are the following:

1. It can be stored without risk of fire, if it comes in contact with water.
2. It is delivered in packages of definite weight, generally 50 lb., which are more convenient to handle than the lump lime, which is furnished either in bulk or in barrels.
3. It does not deteriorate appreciably during a reasonable period of storage, while lump lime deteriorates during shipment and even under the most favorable conditions of storage.
4. Hydrated-lime solutions do not require screening for handling through pumps or small orifices.
5. More uniform results and greater accuracy of treatment are obtained than with lump lime, because of the greater ease of control.

While all of these advantages are important from an operating standpoint, accuracy of treatment stands first. It is true that accurate results can be and are obtained with lump lime, yet its use requires practically air-tight storage bins and special methods and care in slaking, as well as special training in the methods of slaking.

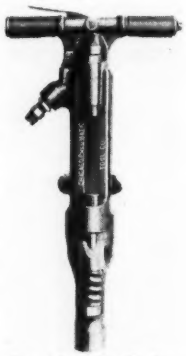
On the other hand, hydrated lime is slaked when received, so that it is only necessary to apply a specified amount to a given quantity of raw water. Because it is a dry powder, it passes readily through dry-feeding devices. Because of its uniformity and ease of handling, it is used almost universally in municipal water softening. Its use is not only preferable from an operating standpoint, but in practically every case of railway water supply it is more economical. The Committee on Water Service and Sanitation of the A.R.E.A., after a thorough study of the subject, concluded that hydrated lime is more economical than lump lime at plants where the amount of water treated daily is less than 2,000,000 gal.



NEW AND IMPROVED DEVICES

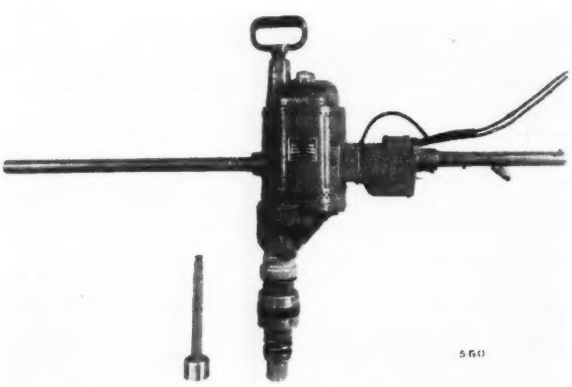
Two New Power Spike Drivers

THE Chicago Pneumatic Tool Company, New York, has added to its line of electric and pneumatic tools, two new spike drivers, one electrically operated for driving or backing out screw spikes, and the other pneumatically operated for driving cut spikes. The new screw spike driver, which is known as the Little Giant No. 4B, is a rotary tool, weighing 115 lb. complete with socket wrench, which can be furnished to operate on 115-volt, 230-volt or 600-volt direct current. The tool has both a spade handle and a cross-bar handle, one of the bars of the cross-bar handle being equipped with a switch. The over-all length of the tool is 41½ in.



The New Cut-Spike Driver

One of the outstanding features of the new spike driver is a specially designed cushion clutch with a spring adjustment, which kicks out at a predetermined load. Through this device, all spikes are driven to a uniform pressure against the rail or tie plates, the wrench stopping automatically without shock to the operator or tool when the spikes become securely seated. Two 25-foot lengths of single-conductor cable are furnished with the 600-volt tool, while one 25-foot length of No. 3 conductor cable is furnished with both the 115-volt and 230-volt tools.

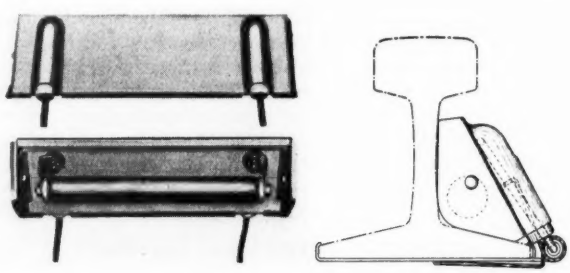


The New Screw-Spike Driver

The new pneumatic cut-spike driver, known as Model CP-116, is a well-balanced tool, weighing 74 lb. It is of all-steel bolted construction, without valves, and has only one moving part, the piston. A feature of the tool is that it is lubricated automatically from an oil reservoir in the handle. It is said that numerous tests of the new driver prove that it will not freeze in the coldest weather. According to specifications, the tool has an over-all length of 25½ in., a cylinder diameter 1⅜ in. by $2^{13}/_{16}$ in., and a 4-inch stroke. It is designed for use with the usual type of tie tamper air compressor equipped with ¾-inch hose.

A New Electric Switch Heater

AFTER severe service tests, the Electric Service Supplies Company, Philadelphia, Pa., has put on the market a new electric switch heater which is designed to keep switches free of ice and snow. This heater, which is known as the Elec-Trac switch heater, is a simple, self-contained unit, consisting essentially of a copper-bearing pressed steel frame or housing which fits up against the web of the rail, in which is mounted an asbestos insulator with an enclosed tubular heating element protected by a stainless steel covering. The heating element, together with its contacts, is readily renewable as is also the asbestos board insulation, which serves as a deflector of the heat and as an insulator. Connections to the heater are through porcelain plug connectors, which are well insulated from the frame, and which make it possible to remove and replace the heater quickly without otherwise disturbing the wiring system.



Views Showing the Outside and Underside of the New Switch Heater as Well as its Method of Application to the Rail

Standard Elec-Trac heaters are suitable for use on tee rails weighing 80 lb. per yd. or more, and a special form of housing is supplied for use on special trackwork where bolts or other obstructions prevent a close-up application of the standard heater. The standard heater is merely clamped to the rail and can be attached without moving the ballast or cutting the ties.

The standard units have a capacity of approximately 600 watts and are designed to operate on 110 volts, so that they may be connected in multiple on the secondary side of a standard 110-volt transformer. On 220-volt circuits, they can be connected two in series, and on electrified lines operating on 550-volts d. c., they can be connected five in series. Under ordinary conditions the heaters are installed at approximately every second tie, which requires about 14 units for use with 15-ft. switch points. The units weigh approximately 2½ lb. each, exclusive of the spring clamps which hold them to the rail.

Improves Embankment Boring Machine

A SERIES of mechanical improvements over a considerable period of time has served to increase the speed and efficiency of operation of the embankment boring machine which is manufactured by the Young Engine Corporation, Canton, Ohio. The purpose of this machine is to bore under railway, highway and other embankments for the insertion of pipe lines. Its use

The Young Road-Crossing Boring Machine in Position

eliminates the necessity of excavating an open ditch through the embankment and of shoring up the track. Briefly the machine consists of a power plant, a hollow rotating sleeve, a cutting head, a jacking arrangement for forcing the rotating sleeve and cutting head forward, and a frame for supporting the jacking and boring parts. Exclusive of the power plant, the machine weighs about 3,300 lb.

The frame consists of two specially-constructed parallel I-beams, 9 ft. long and 2½ ft. apart, each of which has a rack attached to its top surface. A ratchet-lever arrangement moves along each rack and is secured to a cross-bar which engages the end of the hollow rotating sleeve. This sleeve, which is 8 in. in diameter, is supported between and moves parallel with the I-beams.

At one end of the frame the hollow sleeve passes through a housing, from which it is given a rotating motion. This end of the sleeve is provided with a forged steel pipe flange, 8 in. by 13½ in., to which is bolted the pipe or casing to be installed in the embankment. The forward end of this casing is provided with a suitable cutter head which is usually attached by welding.

When in service the boring machine is lowered into the ditch and the power plant is placed on the ground to one side. Power is transmitted through an adjustable drive shaft with universal joints to the upper sprocket of a chain and sprocket drive on the boring machine, which can be set at the proper height. The rotating motion of the cutting head and the forward pressure of the jacks are the agencies which force the pipe through the embankment.

The movement of the hollow sleeve is about 6 ft. and when the pipe has been forced into the embankment this distance the sleeve is detached from the casing, returned to the starting position, and an 8-in., 5½-ft. extension joint is inserted for the next forward movement. This process is repeated until the entire length of pipe has been inserted in the embankment. When possible and desirable the pipe to be installed is welded or screwed into one piece and the boring machine is placed in the ditch at a distance from the embankment equal to the length of the pipe.

When the size of the casing is other than 8 in. a suitable swedge nipple is used to reduce or increase the size to fit the flange of the rotating sleeve. This machine is said to be capable of installing casings up to 30 in. in diameter. The type of cutter head used varies with the nature of the ground and the size of casing. For smaller pipes a solid cutter may be used, which forces the dirt back into the sides of the embankment. A hollow cutter head is used for larger casings, and in this case the broken-up dirt is removed through the casing and hollow sleeve.

This machine is powered with a 30-hp. gasoline engine which weighs approximately 1,100 lb. When unloading, loading, and lowering the boring machine in the ditch, the common practice is to use a three-legged tripod with a chain hoist.

The operation of this machine is both rapid and accurate. In one case where a 140-ft. length of 10-in. casing was installed in a railway embankment, the job was completed in less than two days working time and the casing emerged from the embankment within three inches of the desired point.

Paved Invert Perfected by Armco

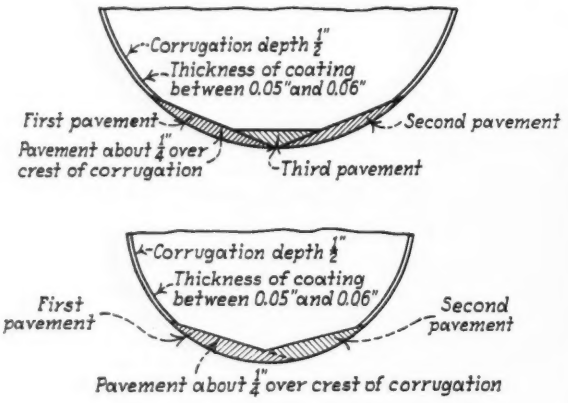
OBSERVATION of the paved invert culvert pipe of the Armco Culvert Manufacturers Association, Middletown, Ohio, during the six years in which it has been in service, has shown that the value of the asphaltic paved invert, particularly in regard to the protection which it affords against erosion, would be enhanced if the width of the pavement were increased. Accordingly a design of paved invert has been developed which affords protection over a greater area of the interior of the pipe and raises the point of initial deterioration to the sides where the erosive action is less severe. This increased width has been secured by installing two or more flat pavements in the pipe, depending on its diameter and the conditions under which it is to serve.

View Through a Paved Invert Pipe in Service

In the smaller diameters of pipe, two flat pavements are installed, which overlap in the bottom of the pipe, forming a V-shaped trough, the sides of which protect

a greater area than would be possible with the single pavement. With this type of paved invert, the thickness of the pavements over the crest of the corrugations is about ¼ in.

In the larger diameters of pipe where three pavements are desirable, the first two pavements are installed as in the smaller sizes except that they form a trough in the pipe without overlapping, and the third flat pavement is installed in this trough in order to


Corrugation depth ½"
Thickness of coating between 0.05" and 0.06"
First pavement
Second pavement
Pavement about ¼" over crest of corrugation
Third pavement
Corrugation depth ½"
Thickness of coating between 0.05" and 0.06"
First pavement
Second pavement
Pavement about ¼" over crest of corrugation

Above — Large Diameter Pipe with Three Pavements
Below — Small Diameter Pipe with Two Pavements

provide protection at the point of greatest erosion. In this design the thickness of the pavements over the crest of the corrugations is also about ¼ in.

The asphalt coating on the interior of Armco pipe now varies in thickness from a maximum at the bottom of the invert to a minimum at the horizontal diameter. This coating is also subjected to a series of severe tests to determine its ability to withstand various destructive forces such as shock, high temperature and abrasive wear.

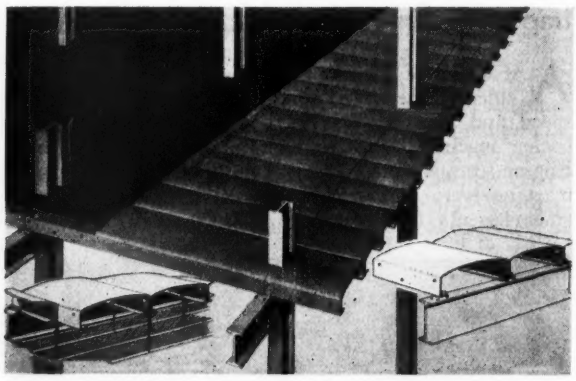
New Light-Weight Floor System

THE Truscon Steel Company, Youngstown, Ohio, has developed a light-weight, heavy-duty type of floor construction, known as the Truscon Channel-plate floor system, which is designed to offer important economies in floor construction for both medium and heavy loading, and especially when the total floor load is to exceed 150 lb. per sq. ft. It is said that the flooring is adapted particularly for use in railroad piers, industrial buildings, warehouses, and other similar multiple-story buildings where light weight, strength and rigidity of floors are important factors.

This new type of floor system, which is of steel, consists essentially of a series of new sections which are pressed from open-hearth steel plates of varying thicknesses into a shape resembling a channel, but with their tops, or broadest surfaces, arched to provide a crown height of ¾ in. These channel plates, the exact shape of which is shown in the accompanying illustrations, are laid adjacent to each other, which brings the webs of adjoining plates together. The double webs which result are bolted together, and, with their respective lower flanges form I-beam sections which occur at intervals of 20 in., 22 in. or 24 in., depending upon the width of the plates. The channel plates themselves, which are made in lengths from 6 ft. to 30 ft., are carried on the structural supporting frame provided, to which they can be bolted, welded or riveted. Any of a number of types of wearing surfaces can be used over the channel plate construction, such as concrete reinforced with steel fabric, or asphalt mastic.

Among a number of advantages claimed for the channel-plate floor system are light weight, simplicity of design and erection, economy in material and labor, saving in time, all-year erection, and safety.

The shapes are delivered ready to erect, and are set into place without the necessity for heavy hoisting equipment or for any form of braces or supports. They can be laid with the structural steel frame, story by story, as a working deck or for the storage of materials. At the



Sketch Drawing Make-Up of Truscon Channel-Plate Floor Construction

same time, this plan of construction, without falsework, precludes interference with workmen on the floor beneath, and provides a factor of safety for workmen, whether operating above or beneath. The channel-plate floor system design conforms to specifications of the American Institute of Steel Construction, and can be fireproofed readily according to the requirements of local underwriters.

The first use of this new floor system has been made in a new export pier of the Erie at Weehawken, N. J.,

The Interior of the Erie's Pier D Showing the Top and Under Side of Channel-Plate Construction

where approximately 143,000 sq. ft. was erected in two floors designed to carry 200 lb. and 300 lb. live load. One of the most interesting facts in connection with this pier is that the channel plate construction permitted the erection of a three-story structure on a pile foundation, which was constructed originally for a two-story structure of a heavier type of construction.

What Our Readers Think

Titles With Definite Meanings

Buenos Aires, Argentina.

To the Editor:

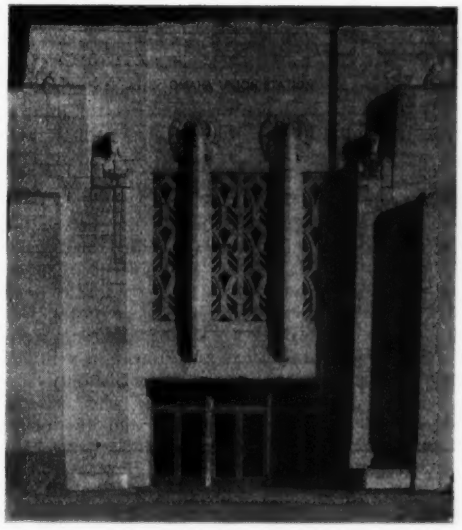
I note an editorial on page 327 of your August issue recommending the use of the term "trackman" rather than "laborer." This is a suggestion with which I am in full accord. In the Argentine, some of the railways use the term "caminaro" instead of "peon," which compares exactly with the terms you suggest.

This brings up the question of titles for engineers of and below the rank of division engineer. While it is probably true, as you say, that most men are more concerned about their pay than about their titles, yet a proper title has not only a stimulating effect on the man who bears it, but it gives him a definite standing which is recognized by officers and employees of other departments with whom he has to deal.

There are still a number of roads in the States and Canada where the men to whom I refer are classed as instrumentmen, which means little or nothing to other departments. On the other hand, such titles as assistant engineer, resident engineer or assistant division engineer, if rightly applied, have definite meanings. On one railway upon which I was employed, this practice appeared to be a relic of construction days. For many years after the road was opened for operation, the position properly designated as that of division engineer was still listed as resident engineer, and this officer's assistants were called instrumentmen. Eventually the title was changed from resident engineer to division engineer, but his assistants still retain the old designation of instrumentmen. Yet they carry much heavier responsibilities and need to be much more experienced men than instrumentmen on construction.

For a junior assistant in charge of a relatively unimportant job, the title of inspector seems to be fair enough and descriptive of his duties. The regular assistants on general maintenance, however, deserve some title that indicates that they are engineers and that their position has some dignity.

ARGENTINO.



Tenth Street Entrance to New Union Station at Omaha

New Books

Data on Douglas Fir

DOUGLAS FIR USE BOOK.—204 pages, illustrated, 8 in. by 5 in. Bound in cloth. Published by the West Coast Lumbermen's Association, 364 Stuart Building, Seattle, Wash. Single copies $1. In lots of 25 or more, 85 cents each.

This is a manual for the use of the engineer and architect, which has been prepared to give all the information relative to the properties of Douglas fir required for design. In addition to an exposition of grading rules, particularly as applied to those given for Douglas fir, and tables of recommended working stresses, the book contains tables of loads, deflections and shearing stresses for beams, covering five grades of fir and embracing sticks ranging from 2 in. by 4 in. to 20 in. by 30 in., in spans from 3 ft. to 40 ft.

Report of B. & B. Convention

PROCEEDINGS, American Railway Bridge and Building Association, Edited by C. A. Lichty, secretary of the association. 272 pages, illustrated, 6 in. by 9 in., cloth. Published by the association, 319 North Waller avenue, Chicago.

This issue of the proceedings of the association contains a complete report of the fortieth annual convention which was held at Louisville, Ky., on October 21-23, 1930. It is composed for the most part of the committee reports together with the discussions which followed their presentation and a number of technical and general papers. The subjects which were reported on are as follows: Relative Advantages and Costs of Precast Concrete Crib Walls and Monolithic Walls; Masonry Failures—Their Causes and Remedies; Programming Bridge, Building and Water Service Work; Use of Power Tools and Equipment for Bridge and Building Crews; Inspection and Maintenance of Water Tanks and Their Appurtenances; Modernizing of Station Buildings; and Maintenance of Turntable and Drawbridge Machinery. Other material includes papers by H. M. Priest, assistant engineer, American Bridge Company, and W. R. Roof, bridge engineer, Chicago Great Western, on Welding in Structural Steel Bridge Strengthening; by H. I. Benjamin, assistant engineer of bridges, Southern Pacific, on the Suisun Bay Bridge and by F. C. Baluss on the Progress of Safety in Bridge and Building Work. An address by W. R. Cole, president of the Louisville & Nashville, on some outstanding problems and difficulties confronting the railroads is also included.

On the Colorado & Southern

NEWS OF THE MONTH

Railway Employment Declines

The number of employees in the service of Class I railroads as of January 15, was 1,334,053, a reduction of 22,000 as compared with December 15 and of 14.54 per cent as compared with January, 1930, according to a report of the Interstate Commerce Commission. It was also a reduction of 16.35 per cent as compared with January, 1929.

Ship Fruit from Florida to Chicago by Truck

The first shipment of fruit from Florida to Chicago by motor truck was made early in March, when three truckloads of oranges completed the trip in three days. During the 30-week shipping period ending March 7, a total of 1,680,000 boxes of fruit were trucked out of Tampa, Fla., as compared with 1,000,000 during the same period last year.

Railways Use Less Coal

The Class I railroads of the United States consumed 97,764,206 net tons of coal in 1930, a decrease of 15,098,258 net tons, or 13.8 per cent, under 1929, according to reports issued by the United States Bureau of Mines and the National Coal Association. The average cost of coal in 1930 was $2.34 a net ton, as compared with $2.40 a net ton in 1929, a reduction of 6 cents a ton or 2.5 per cent.

Contract for Missouri River Bridge Let by M-K-T

A contract for the design, fabrication and erection of the steel superstructure of a bridge over the Missouri river at Boonville, Mo., has been awarded to the American Bridge Company, New York, by the Missouri-Kansas-Texas. The estimated total cost of the structure is $1,233,000 and it is expected to be opened for traffic about January 31, 1932. The superstructure will be designed for Cooper's E-70 loading and will consist of three 300-ft., one 408-ft. vertical lift, and one 247-ft. through riveted-truss spans, and one 60-ft. through plate-grider span. The vertical lift span is the longest of this type yet constructed for railway service and will have a vertical clearance above low water of 57 ft. The substructure of the bridge was constructed during 1930 under contract by the Kansas City Bridge Company.

Railway Resolution Fails to Pass

A resolution to direct the Interstate Commerce Commission to conduct an investigation of the various forms of transportation in competition with the railroads and to report recommendations for legislation in December when Congress reconvenes failed to pass in the last hours before Congress adjourned on March 4. The resolutions had been reported favorably by committees in both the House of Representatives and the Senate but several senators desired to offer amendments, causing consideration of the resolution to be deferred.

Store Door Service Extended By North Western

In addition to its container car service between Chicago and Milwaukee, Wis., which was established early this year, the Chicago & North Western has instituted store-door pick-up and delivery service of less than car load quantities from Rockford, Ill., and Beloit, Wis., to Chicago. This service entitles the shipper to complete store-door to store-door service at a rate of 38 cents per hundred pounds on less-than-car-load shipments of designated machines and machinery.

Roads Ask Lower Rates on Automobiles

Reduced rates on motor cars moving from the principal manufacturing and assembling centers to points within 500 miles are being asked by the Southwestern and Eastern roads, as a means of meeting extensive truck competition. The former roads have petitioned the Interstate Commerce Commission for authority to establish special reduced rates on shipments of automobiles from 10 of the principal plants while the eastern roads are filing tariffs containing similar reductions. These moves are being made after a series of conferences between representatives of the railway and automobile industries. In their petition to the Interstate Commerce Commission the Western roads point out that until a short time ago nearly all motor cars moved by rail but that during the past year the practice of shipping them by truck, generally four on a truck, has developed to such an extent that the railways are faced with the loss of practically all this traffic.

January Freight Traffic

Freight traffic handled by the Class I railroads in January amounted to 30,313,736,000 net ton-miles, a reduction of 6,404,026,000 net ton-miles, or 17.4 per cent, as compared with January, 1930, according to reports compiled by the Bureau of Railway Economics. It was also a reduction of 8,895,900,000 net ton-miles, or 22.7 per cent, under January, 1929. The volume of freight handled in the Eastern district in January was 18.3 per cent lower than in 1930, in the Southern district the decrease was 19.4 per cent and in the Western district it was 15.4 per cent.

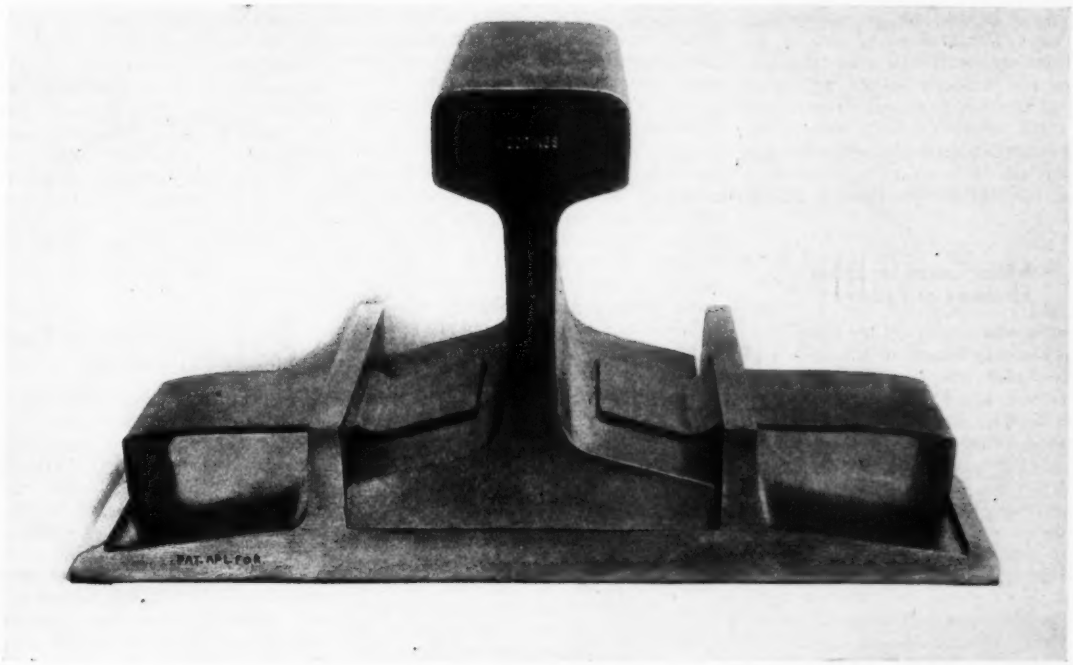
Dimensions of Trucks Limited by Indiana Bill

A bill providing definite limits for the height, length, width, weight and lighting of motor trucks has recently been passed by the Indiana legislature and has been approved by the Governor. This bill, which will become effective on January 1, 1932, provides that trucks shall not be more than 8 ft. wide and 12 ft. high and that the length of a single vehicle shall not be more than 33 ft. In addition, it limits the length of combinations of vehicles coupled together to 40 ft., and the axle weight on pneumatic tires to 16,000 lb. while on solid tires the limit is 80 per cent of that on pneumatic tires.

Explosives Handled Safely

In 1930 the railroads of the United States and Canada handled 500,000,000 lb. of dangerous explosives without a fatality and with a property loss of only $71, according to the report of the Bureau of Explosives of the American Railway Association. In connection with the movement of these materials only two persons were injured, one when several toy torpedoes exploded and the other when an automatic pistol discharged inside a trunk. When the Bureau of Explosives was organized in 1907, the reported property loss resulting from the

WOODINGS
Tie Plate Construction



Simple to Install with Small Labor Cost

Minimum Number of Parts

Saves Spike Killing of Ties

Does Not Interfere with Wave Motion of Rail

Reduces Rail Creeping

Easy to Repair in Case of Damage from Derailment

Holes Punched for Either Lag Screws or Cut Spikes as Specified

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WORKS AND GENERAL OFFICES

VERONA, PENNA.

transportation of explosives was $500,000. In 1930 the total property loss incurred in connection with the transportation by rail of all dangerous articles was $420,572, which is the lowest total on record and is less than 45 per cent of the average for the past 10 years. In 1929 the property loss amounted to $832,968 and in 1928 it was $871,001.

Barge Line Extended to Illinois river

In the face of strong railway opposition, the Interstate Commerce Commission has issued a certificate authorizing the federal barge line of the Inland Waterways Corporation to extend its operations to the Illinois river and has directed the railroads to join with it in the establishment of through routes and joint rates. Between ports where the shipment is transported by barge line the joint through rates are to be from 10 to 20 per cent below the lowest all-rail rates.

A Motor Coach for Either Highway or Railway

A motor coach designed for either railway or highway operation and known as the Ro-Railer has recently been constructed in England for the London, Midland & Scottish Railway. In appearance the coach differs only slightly from an ordinary highway motor coach except that it is equipped with flanged wheels for rail operation and rubber tires for highway service. When in highway service, the two sets of wheels are concentric and as the flanged wheels are the smaller they revolve idly. When in service on rails the road wheels are lifted out of the way without removing the axle.

Unprofitable Passenger Service to be Studied

An attempt to solve the problem of unprofitable passenger train operation from a new angle is being made by the western roads which have appointed seven committees to investigate the possibility of eliminating or reducing duplicate service, the pooling of competing service, the further curtailment of unprofitable branch line service and the substitution of less expensive types of service. This action is the result of a meeting of the presidents of the western roads which was held at Chicago on February 26 and which was attended by representatives of the Interstate Commerce Commission which is sponsoring the investigation.

Full-Crew Law Not Applicable to Motor Trains in Ohio

The railroads in Ohio are not required to comply with the provisions of the state full-crew law in the operation of gasoline-driven motor trains, according to a recent decision of the Ohio Supreme Court. This decision was handed down on March 11, and sustained the action of the Ohio Commission of Public Utilities in refusing to issue an order to compel the Wheeling & Lake Erie to comply with the full-crew law. The commission had been asked by the Brotherhood of Locomotive Firemen and Enginemen to require the railroad to use a crew of four men on a rail motor-car train operated between Pittsburgh, Pa., and Toledo, Ohio. The commission refused the order and the case was appealed by the brotherhood to the supreme court.

Class 1 Roads Earn 2.28 Per Cent in January

Net railway operating income of the Class I railroads in January totaled $33,849,116, which was at the annual rate of 2.28 per cent of their investment, as compared with $55,773,152, or a rate of return of 3.81 per cent in January, 1930, according to reports compiled by the Bureau of Railway Economics. Total operating revenue for January this year amounted to $365,899,754 as compared with $451,458,786 a year ago, while expenses decreased from $356,664,032 in January, 1930 to $294,081,947 in the first month of this year. The decrease in operating expenses, however, was not sufficient to maintain the operating ratio, which increased from 79.00 to 80.37.

Safety Among School Children

A campaign to reduce the number of railway accidents involving children of the public schools has been announced by the Committee on Education of the American Railway Association. This campaign is supplementary to the regular monthly circular issued to the safety departments of the railroads and the committee suggests that this phase of railway safety work be given special attention in the latter part of April, the month of May, and the first half of June. In connection with this work, two documents have been prepared, one an illustrated circular of pocket size summarizing briefly the lessons of past years, and the other a large colored poster depicting the remorse of a boy whose habit of jumping on trains has cost him the loss of a leg. The committee recommends putting these posters in school rooms, particularly in rural districts, in school buses and in other suitable places.

I. C. C. Denies Petition to Vacate Grain Rate Order

The Interstate Commerce Commission has denied the petition of the western roads asking for a vacation or the indefinite postponement of the commission's order of last July providing for a general revision of grain rates throughout the western district and for export, which it is estimated will reduce the revenues of these roads about $20,000,000 a year. In their petition the roads pointed out that the record on which the rate decision was based was closed on September 22, 1928, and that the effects of the present business depression on the financial condition of the roads should warrant a reconsideration of the order. However, the application of the tariff-publishing agents of the roads requesting that the effective date of the order be postponed from April 1 to July 1 on the ground that it is physically impossible to complete the tariff changes in the allotted time was granted by the commission.

Eleven Roads to Establish Store-Door Service

Eleven southwestern roads have filed tariffs with the Interstate Commerce Commission establishing door-to-door package service at rates equal to the present all-rail rates. The service is to be operated by the railroads on their own bills of lading, trucking service being contracted for privately by the roads. This service is being established by the following roads: The Missouri Pacific; the Texas & Pacific; the St. Louis-San Francisco; the St. Louis Southwestern; the Missouri-Kansas-Texas; the Southern Pacific; the Chicago, Rock Island & Pacific; the Atchison, Topeka & Santa Fe; the Kansas City Southern; the Chicago, Burlington & Quincy; and the Louisiana & Arkansas.

Effect of Low Passenger Fares Still Uncertain

The effect on railway passenger traffic of the two cents a mile and other low fares that have been introduced on a number of roads since the first of the year as a means of stimulating travel is as yet surrounded with uncertainty. The somewhat indifferent success with which these efforts have been met so far is attributed in large measure to the business depression and the feeling is prevalent among railway men that several months must elapse yet before a definite statement can be made as to the success of the plan. As a result of its $50 coach rate between Chicago and California points, the Atchison, Topeka & Santa Fe has experienced some increase in its business between these points and has added extra coaches to its fast mail train. However, the effect of the low rate has been offset somewhat by similar reductions in motor coach rates between these points. As a result of the system-wide two-cent fare which was placed in effect on the St. Louis-San Francisco on February 1, the sale of tickets has shown a substantial increase at certain points, while at others it has declined. Passenger traffic officials of this road regard the results as encouraging but not definite and believe that after 90 days the effectiveness of the rates should be manifested. Passenger traffic officers of the Chicago & North Western, the Chicago, Milwaukee, St. Paul & Pacific, the Chicago, Rock Island & Pacific and the Great Northern regard the results of the various low fares which have been established on these roads as somewhat discouraging. During January and February travel from Chicago to California on all roads decreased 20 per cent as compared with the same period last year and in contrast to a 5 per cent decline experienced in the same months of 1930 from the previous year.

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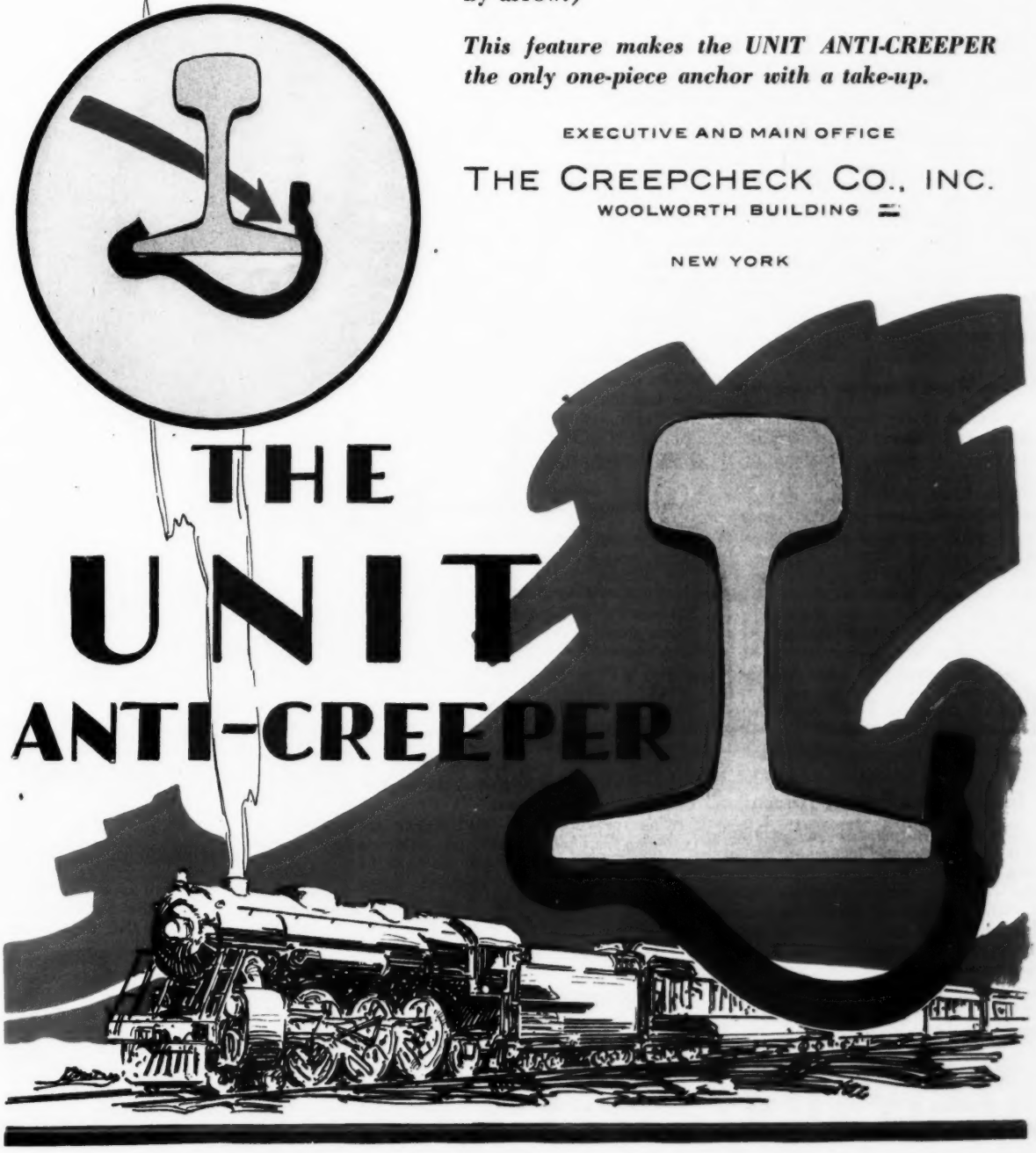


ASSOCIATION NEWS

American Railway Engineering Association

At a meeting of the Board of Direction immediately following the conclusion of the convention on March 11, it was voted to return to a three-day meeting for 1932, this meeting to be held on March 15-17. The National Railway Appliances Association has also arranged to present its exhibit coincident with this convention, opening at the Coliseum on Monday, March 14, and continuing until Thursday afternoon, March 17.

At the annual convention on March 11, Earl Stimson, chairman of the Rail committee, announced that financial arrangements have been completed through contributions by the American Railway Association and the Rail Manufacturers for the inauguration of an extended investigation of transverse fissures. This investigation, which is to extend over five years, will involve studies in the field and also in the laboratory, the latter to be made at the engineering experiment station of the University of Illinois.

The Wood Preservers Association

Members of the Executive committee met at the Palmer House, Chicago, on March 10, at which time plans for the summer meeting of committees were discussed. It was decided that this meeting, which is held jointly with the Committee on Wood Preservation of the A. R. E. A., will be held at Ottawa, Can., on May 26-27, affording an opportunity to visit the Canadian Forest Products Laboratory and to observe the work which is being done to further the science of wood preservation there.

Measures were also taken to expedite the completion of the annual statistics on wood preservation to permit them to be included in the annual proceedings hereafter.

The Bridge and Building Association

Thirty-four members of the association met at luncheon in Chicago on Wednesday, March 11, during the convention of the American Railway Engineering Association. Following the luncheon, members of the Executive committee met informally to review the work of the organization and particularly to ascertain the status of the reports that are in process of preparation by the eight technical committees.

The Proceedings of the Louisville convention have come from the printer and were distributed to the members during the month.

Two past presidents of the association died in March, as noted on a following page, Herman Rettinghouse, who presided over the 1911 convention, and James S. Robinson, who presided over the 1924 convention.

The Roadmasters Association

Members of the Executive committee and chairmen of technical committees met for dinner at the Hotel Stevens, Chicago, on Monday evening, March 9, to review the work of the association and particularly to receive reports from the committee chairmen on the status of their work. It was evident from the statements made by the chairmen that the work of the committees is more than usually far advanced, forecasting a constructive program for the next convention.

The Proceedings of the last convention are now in the bindery and it is expected that they will be ready for distribution to the members early in April.

Metropolitan Track Supervisors' Club

The next meeting of the Metropolitan Track Supervisors' Club will be held on April 23, at the usual place, Keen's Chop House, 72 West Thirty-Sixth street, New York. Following dinner, which will be served at 6:30 p. m., the main subjects for discussion will be "Six-Hole versus Four-Hole Joints" and "When and How Often Should Track Bolts be Tightened." These subjects will be handled by a committee of which F. J. Meyer, assistant engineer maintenance of way, New York, Ontario & Western, is chairman.

Maintenance of Way Club of Chicago

Fifty members and guests of the club were present at the meeting on Wednesday evening, March 18, when Elmer T. Howson, president of the Roadmasters Association, discussed current trends in track maintenance. The speaker reviewed the marked changes that have taken place in the service which track must render, in the nature of the track structure, and in the methods of providing for its maintenance. He also showed how these changes have influenced the trends of organization and methods. Many of those present participated in the general discussion which ensued.

The speaker at the last meeting for the season, which will be held on Wednesday evening, April 22, will be John V. Neubert, chief engineer, maintenance of way, New York Central, who will talk on "Ballast and Its Effect on Maintenance."

An International Station—The railway station at Eisenstein is probably the only one of its kind in the world, in that the building itself is situated in two countries. The boundary line between Germany and Czecho-Slovakia passes directly through the middle of the station building.

PERSONAL MENTION

General

Charles C. Warne, first assistant purchasing agent of the New York Central, and formerly assistant division engineer on that road, has been appointed general purchasing agent with headquarters as before at New York. Mr. Warne was born in England on July 15, 1881, and received his education at the University of Pittsburgh, from which he was graduated in 1903. He obtained his first railroad experience in 1903 as a rodman in

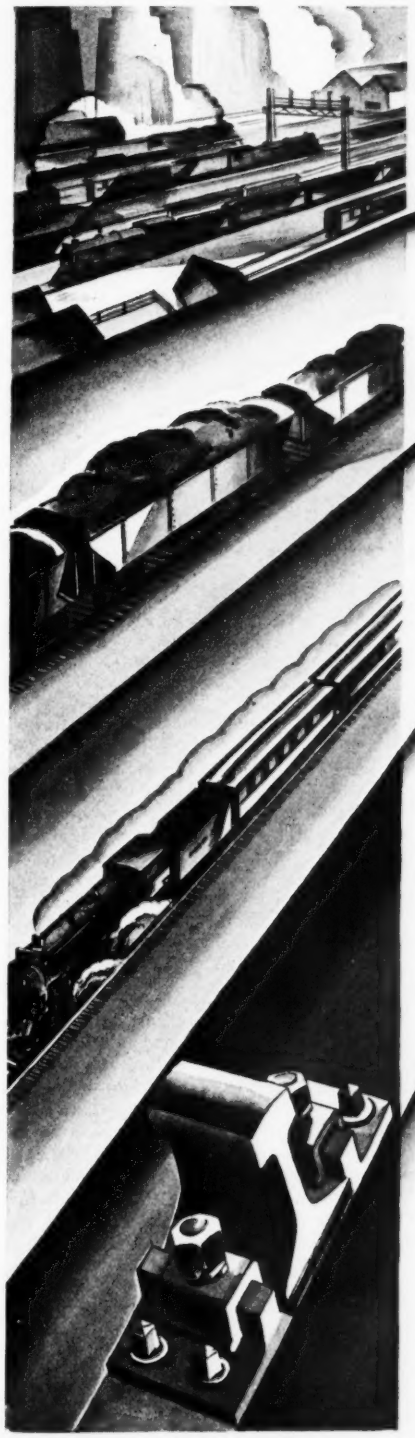
Charles C. Warne

the maintenance of way department of the Western division of the New York Central & Hudson River (now the New York Central). From January, 1904, to March 1905, he served as assistant supervisor of track and on the latter date he was appointed transitman and draftsman. In April, 1906, Mr. Warne was appointed assistant division engineer, and from September, 1912, to January 1, 1914, he served as lumber agent. In January, 1914, he was promoted to assistant to the purchasing agent and from April, 1919, until his recent appointment, he has served as first assistant purchasing agent.

Engineering

J. N. Barnett has been appointed chief engineer of the Yosemite Valley, with headquarters at Merced, Cal., to succeed **G. H. Nickerson,** deceased.

Coincident with the consolidation of the Greenville and Vicksburg Route divisions of the Illinois Central, **C. J. Carney,** division engineer of the latter division, with headquarters at Vicksburg, Miss., has had his jurisdiction extended to include the former Greenville division. **C. P. Brevard,** supervisor of track, with headquarters at Harriston, Miss.,



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TRACK CONSTRUCTION

has been appointed assistant engineer, with headquarters at Dubuque, Iowa, succeeding **G. J. Nash,** who has been assigned to other duties.

P. J. McCarthy, assistant engineer on the Kansas City Southern, with headquarters at Kansas City, Mo., has been appointed acting division engineer of the Southern division, with headquarters at Texarkana, Tex., to replace **W. G. Morgan,** whose death is noted elsewhere in these columns.

J. L. Kirby, engineer maintenance of way of the Seaboard Air Line, with headquarters at Norfolk, Va., has been appointed chief engineer maintenance of way with the same headquarters, a newly created position. The position of engineer maintenance of way has been abolished.

H. L. Benson, instrumentman on the Canadian National, with headquarters at Allandale, Ont., has been promoted to division engineer of the Hornepayne division, with headquarters at Hornepayne, Ont., succeeding **H. J. Black,** who has been transferred to the Capreol division, with headquarters at Capreol, Ont., where he succeeds **A. H. Willett,** who has been assigned to other duties.

W. G. Powrie, assistant engineer in the office of the general supervisor of bridges and buildings of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Chicago, has been promoted to division engineer of the division formed by the consolidation of the Iowa & Minnesota and Southern Minnesota divisions. The new division is known as the Iowa & Southern Minnesota division, and Mr. Powrie's headquarters are at Austin, Minn. Previous to the consolidation of the two divisions, their organizations did not include the position of division engineer.

N. R. Hunter, whose promotion to division engineer on the Pennsylvania with headquarters at Chambersburg, Pa. was noted in the February issue, was born on February 27, 1889, at Philadelphia, Pa. He received his early education at the Episcopal Academy, Philadelphia, and his higher education at Lafayette College, from which he was graduated in 1911. He entered railway service with the Pennsylvania as a rodman on the Pittsburgh division on November 1, 1911, and on May 15, 1916, he was promoted to transitman in the general offices at Pittsburgh. On October 16, 1916, he was promoted to assistant supervisor on the Buffalo division and on June 1, 1917, he was transferred to the Allegheny division. On September 1 of the same year he was furloughed for military duty, returning to his former position on January 1, 1918. On July 1, 1919, he was appointed acting assistant supervisor on the Pittsburgh division, and on September 1, of the same year, he was made assistant supervisor on that division. On May 1, 1920, he was transferred to the Philadelphia Terminal division and on March 16, 1921, he was again transferred to the New York division. On July 21, 1921, he was promoted to supervisor on the Cresson division, and on May 12, 1927, he was transferred to the Middle division, only to be moved again on July 7, 1928, to the Philadelphia Terminal division, where he was located at the time of his recent promotion to division engineer.

A. E. Stewart, whose promotion to division engineer of the Winnipeg Terminal division of the Canadian Pacific was noted in the March issue, was born on September 1, 1892, at Ottawa, Ont., and graduated from the University of Saskatchewan with a degree in civil engineering in 1922. He entered railway service on March 9, 1909, in the construction department of the Canadian Pacific and served in various capacities in this department until 1915, when he obtained a leave of absence to serve with the Canadian Engineers overseas during the war. In 1918, Mr. Stewart was sent to India where he participated in the Afghan war as a lieutenant in the Royal Engineers, returning to the C. P. R. in April, 1920, as a transitman at Revelstoke, B. C. He served in this position until 1923, except during the winters of 1920 and 1921 in which he completed his education, and in this year he was promoted to roadmaster at Lethbridge, Alta. He was later transferred to Bassano, Alta., where he remained until his recent promotion to division engineer with headquarters at Winnipeg, Man.

Track

J. C. Nickerson, roadmaster of the Kentucky division of the Louisville & Nashville, with headquarters at Latonia, Ky., has had his territory extended to include the Cincinnati terminals.

T. F. Hyson has been appointed roadmaster on the Des Moines division of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Des Moines, Iowa, succeeding **J. T. Loftus,** who has been placed in charge of ballasting and rail laying gangs.

Coincident with the consolidation of the Greenville and Vicksburg Route divisions of the Illinois Central, **H. R. Davis,** division engineer of the former division, with headquarters at Greenville, Miss., has been appointed supervisor of track, with headquarters at Harriston, Miss., where he succeeds **B. P. Brevard,** whose appointment as assistant engineer is noted elsewhere in these columns.

P. M. Roeper, whose promotion to supervisor on the Pennsylvania, with headquarters at Catawissa, Pa., was noted in the March issue, was born on June 19, 1904, at McKeesport, Pa. Mr. Roeper received his higher education at the University of Southern California and Carnegie Institute of Technology, and was graduated from the latter institution in 1928. He entered railway service with the Pennsylvania on June 13 of that year as assistant on the engineer corps, with headquarters at Middletown, Pa., and on November 20 of the same year was promoted to assistant supervisor with headquarters at Millersburg, Pa. On April 8, 1929, he was transferred to Altoona, Pa., and on July 1 of that year to Chester, Pa. On January 1, 1931, he was again transferred to Newport, Pa., where he served until his recent promotion to supervisor.

J. Karoll, track foreman on the Medicine Hat division of the Canadian Pacific, has been promoted to roadmaster on the Saskatoon division, with headquarters at Lanigan, Sask., succeeding **J. Stewart,** who has been transferred to Lloydminister, Sask., on the same division, to relieve **A. Campbell,** who has been transferred to Wadena, Sask., on the same division, where he replaces **M. J. Rohne,** who has been granted a leave of absence.

G. M. Aycock, roadmaster on the Missouri-Kansas-Texas, with headquarters at Smithville, Tex., has been transferred to Dallas. **Frank Smith,** roadmaster on this road with headquarters at Waco, Tex., has had his jurisdiction extended to include the territory between Smithville and Granger, Tex., and **F. Hunter,** roadmaster at Houston, Tex., has had his territory extended to include the Smithville yard.

W. I. Elliott, roadmaster on the St. Louis-San Francisco, with headquarters at Ft. Scott, Kan., has retired after nearly 45 years of service with this road. Mr. Elliott was born on November 18, 1860, at Brecksville, Ohio, and entered the service of the Frisco on April 13, 1886, as a trackman at Mulberry, Kan., being promoted to track foreman on March 1, 1890, and to roadmaster on June 21, 1907. He served in the latter capacity at various points, being transferred to Ft. Scott on December 1, 1923.

R. F. P. Bowman, whose promotion to roadmaster on the Canadian Pacific, was noted in the March issue, was born on March 17, 1904, at Lethbridge, Alta., and was educated at Alberta University, from which he graduated with a degree in civil engineering in 1928. Prior to completing his education, Mr. Bowman commenced railway service in the engineering department of the Canadian Pacific and was appointed a transitman in 1926, in which position he served at Cranbrook, B. C., and Lethbridge, Alta. He was located at the latter point at the time of his recent promotion to roadmaster with headquarters at Empress, Alta.

R. A. Ullery, assistant on the engineer corps of the Pittsburgh division of the Central region of the Pennsylvania, has been promoted to assistant supervisor on the Buffalo division, succeeding **C. E. Penniman,** who has been transferred to the Eastern division, where he replaced **H. B. Russell.** Mr. Russell has been transferred to the Pittsburgh division to relieve **F. E. Flynn,** who has been promoted to supervisor on the Monongahela division, with headquarters at Monongahela, Pa., to succeed **C. H. Kooser,** who has been transferred to the Erie and Ashtabula division, with headquarters

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at Niles, Ohio. Mr. Kooser succeeds **C. J. Henry,** who has been transferred to the Pittsburgh division, with headquarters at Trafford, Pa., to replace **J. L. Huron,** whose promotion to assistant division engineer on the New York division, with headquarters at Jersey City, N. J., was noted in the March issue.

James C. Buzard, whose promotion to supervisor on the Pennsylvania, with headquarters at East Aurora, N. Y., was noted in the March issue, was born on February 21, 1890, at Oil City, Pa., and received his education in the public schools and business college at Oil City, supplemented by a correspondence course in railway engineering and drafting. Mr. Buzard entered railway service with the Pennsylvania as a track laborer on June 11, 1906, with headquarters at Oil City, and on February 1, 1909, he was promoted to clerk in the supervisor's office with the same headquarters. On October 1, 1916, he was promoted to track foreman and on December 23, 1918, he was promoted to draftsman in the office of the division engineer, at Oil City. On April 1, 1927, he was promoted to assistant on the engineer corps and on September 10, 1928, he was promoted to general foreman on the Renovo division, with headquarters at Warren, Pa. On January 15, 1929, he was promoted to assistant supervisor on the Panhandle division at Newcomerstown, Ohio, which position he held until February 24, 1930. For the next five months he acted as supervisor on subdivision 5 at Titusville, Pa., and when this division was abolished in July, 1930, he was transferred to the Pittsburgh division at Johnstown, Pa., where he was located at the time of his recent promotion to supervisor.

Bridge and Building

J. R. Griffith, bridge and building supervisor on the Missouri-Kansas-Texas, with headquarters at Smithville, Tex., has had his territory extended to include the Texas Central.

The Iowa & Minnesota and the Southern Minnesota divisions of the Chicago, Milwaukee, St. Paul & Pacific have been consolidated under the name of the Iowa & Southern Minnesota division, and **W. E. Tritchler,** chief carpenter of the Iowa & Dakota division, with headquarters at Mason City, Iowa, has been transferred to the new division, with headquarters at Austin, Minn. **D. C. Wolff,** chief carpenter of the former Iowa & Minnesota division, with headquarters at Minneapolis, Minn., has been transferred to the Hastings and Dakota division, with headquarters at Aberdeen, S. D., succeeding **C. J. McCarthy,** who has been appointed assistant chief carpenter with the same headquarters. **S. J. Kurzeka,** chief carpenter of the former Southern Minnesota division, with headquarters at Austin, Minn., has been assigned to other duties. The jurisdiction of **G. B. Lawrence,** chief carpenter on the Iowa & Dakota division, with headquarters at Mitchell, S. D., has been extended to include the remainder of this division, which was formerly occupied by Mr. Tritchler, and has moved his headquarters to Mason City.

Obituary

J. H. Gallivan, division engineer of the Midland division of the New York, New Haven & Hartford, died at his home in Jamaica Plain, Mass., on February 12.

Francis H. McGuigan, formerly general roadmaster on the Wabash, who retired in 1907 as vice-president of the Grand Trunk, with headquarters at Montreal, Que., died at Montclair, N. J., March 3.

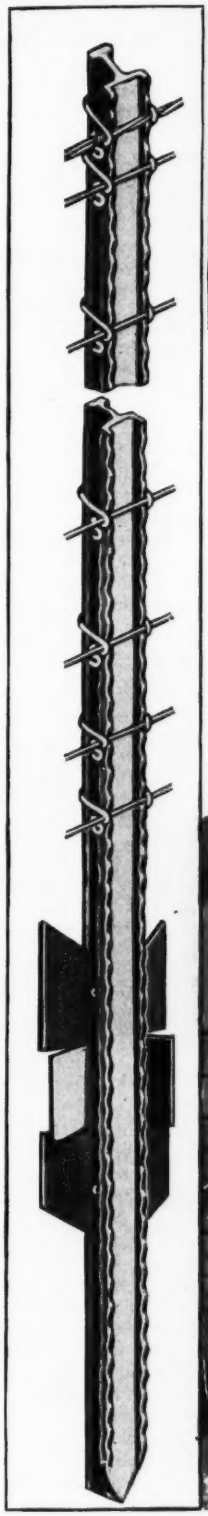
T. D. Maroney, who retired as supervisor of track on the Baltimore & Ohio, with headquarters at Tiffin, Ohio, in 1911, died on January 13. **John Landers,** also a retired supervisor of track on the Baltimore & Ohio, died at his home in Huntington, W. Va., on January 5.

W. G. Morgan, division engineer on the Kansas City Southern and chief engineer of the Texarkana & Ft. Smith, with headquarters at Texarkana, Tex., died in that city on March 7, 1931, after an illness of several months. Mr. Morgan was born at Magnolia, Ark., on November 25, 1884, and received his engineering training at the University of Arkansas, from which he graduated in 1910. He entered the service of the Kansas City Southern on September 15 of the same year as a rodman in the engineering department. In March, 1912, he was promoted to transitman, and on July 1, 1914, he was further promoted to assistant engineer with headquarters at Pittsburgh, Kan. On January 1, 1922, Mr. Morgan was appointed roadmaster at Spiro, Okla., and on July 1 of the same year he was promoted to division engineer of the Kansas City Terminal division with headquarters at Kansas City, Mo. On July 16, 1926, he was transferred to the Southern division with headquarters at Texarkana, being appointed also to the position of chief engineer of the Texarkana & Ft. Smith, a subsidiary of the K. C. S. He retained these positions until his death.

H. Rettinghouse, formerly chief engineer of the Chicago, St. Paul, Minneapolis & Omaha, with headquarters at St. Paul, Minn., died on March 14, at Pasadena, Cal., from cancer of the stomach. Mr. Rettinghouse was born in Germany on July 30, 1861. He was educated in that country and came to the United States in 1882, beginning railway work in 1883 as a rodman on construction work on the St. Paul extension of the Wisconsin Central. The following year he became connected with the Milwaukee, Lake Shore & Western (now part of the Chicago & North Western) and was successively leveler, instrument man and assistant engineer in charge of location, construction and maintenance. Mr. Rettinghouse was engaged in a general engineering business at Ashland, Wis., from 1893 to 1897, including three years service as city engineer of that city. He then returned to the North Western as an assistant engineer in charge of construction and maintenance until May, 1900, and from the latter date to February, 1905, he was superintendent of bridges and buildings of the Ashland division. He was then appointed division engineer of the Southern division of the Wisconsin Central, resigning in January, 1907, to become division engineer on the Chicago & North Western at Boone, Iowa, in charge of maintenance on the East Iowa, West Iowa and Iowa & Minnesota divisions. In April, 1912, he was made superintendent of the Iowa & Minnesota division at Mason City, Iowa, from which position he was promoted to chief engineer of the Chicago, St. Paul, Minneapolis & Omaha in 1913. He held this position until March 1, 1920, when he retired to enter private practice at Sioux Falls, S. D. Mr. Rettinghouse had resided in Pasadena for several years. He was a past president of the American Railway Bridge and Building Association.

James S. Robinson, retired division engineer of the Chicago & North Western, died on March 8 at his home in River Forest, a suburb of Chicago, from heart trouble. He was born on July 31, 1856, and commenced his railway career on May 1, 1880, as a rodman on the Madison division of the Chicago & North Western, with which road he was connected for the next 46 years. After serving in this capacity on various divisions, Mr. Robinson was promoted to assistant engineer on the Madison division in 1882, retaining this position at various points until 1896, when he was appointed acting division engineer of the Galena division with headquarters at Chicago. In 1899 he was promoted to division engineer of the Galena and Wisconsin divisions at Chicago, in which position he served until 1904, when he relinquished his jurisdiction of the Wisconsin division and assumed that of the Chicago terminals in addition to the Galena division. Mr. Robinson retained this position until his retirement on August 1, 1926. He was a past president of the American Railway Bridge and Building Association, having held this position in 1924.

James S. Robinson.



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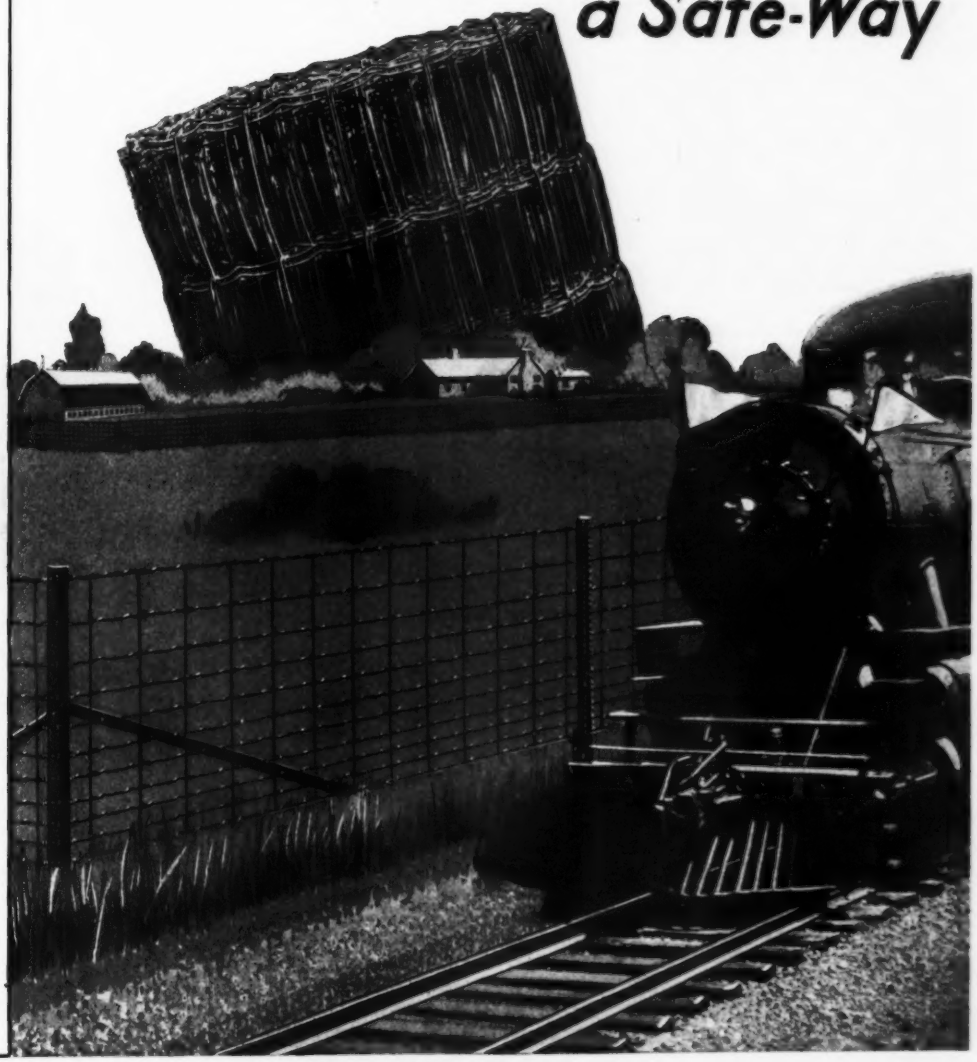

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SUPPLY TRADE NEWS

General

The Canton Culvert & Silo Company, Canton, Ohio, has changed its name to the **Canton Culvert Company.**

The Curtin-Howe Corporation, New York, has moved its executive offices from 11 Park Place to the Chrysler building, 405 Lexington avenue.

The Wood Preserving Corporation, Pittsburgh, Pa., has acquired the exclusive license for the treatment of timber with Montan Wax under the Cooledge patents for all territory outside of the New England states.

The American Cable Company, New York, a subsidiary of the **American Chain Company, Inc.,** Bridgeport, Conn., has licensed the **American Steel & Wire Co.,** Chicago to manufacture preformed wire rope, the patents of which are held by the American Cable Company.

The Bethlehem Steel Company, Bethlehem, Pa., has become a licensee of the **Nitralloy Corporation,** New York, in the field of alloy steels. In the United States there are five other licensees for Nitralloy steel and in addition licenses have been granted to six companies manufacturing steel castings.

The Gifford-Wood Company, Hudson, N. Y., which is engaged in the design, engineering and construction of elevating and handling equipment for coal, ice and other commodities, has acquired the **C. W. Hunt Company,** Staten Island, N. Y., which will be operated hereafter as a division of the Gifford-Wood Company.

The American Steel & Wire Company will establish an office in Worcester, Mass., to handle the sale of the products of the three plants at Worcester and the mills at New Haven, Conn., and Trenton, N. J. **John May,** manager of sales of the electrical and wire rope department in the New York office, has been appointed assistant general manager of sales and will be in charge of the Worcester office, which will be opened on April 1.

The Wood-Preserving Corporation, Pittsburgh, Pa., has acquired the **National Lumber and Creosoting Company,** Texarkana, Ark., with its eight treating plants. With the plants of the Ayer & Lord Tie Company and of the Century Wood Preserving Company which were taken over some time ago, this organization now operates 22 plants for the pressure treatment of timber. No change is contemplated in the personnel of the National Company, **Joshua S. Logan** continuing to serve in the capacity of president.

The Railroad Water & Coal Handling Company, 608 South Dearborn Street, Chicago, has purchased control of the **T. S. Leake Construction Company** of the same address, which it will operate as a separate company. **M. D. Miller,** president of the Railroad Water & Coal Handling Company, has also been elected president of the T. S. Leake Construction Company; **C. O. Congdon,** and **I. W. Miller** have been elected vice-presidents; and **J. H. Wylie,** president of the T. S. Leake Construction Company, has been elected secretary and treasurer of that organization.

Following the acquisition of the **McClintic-Marshall Corporation** by the **Bethlehem Steel Corporation,** the following appointments have been made among the personnel of the former company: **H. R. Walters,** assistant to president; **John N. Marshall,** assistant to vice-president in charge of operations; **Jonathon Jones,** chief engineer; **C. H. Mercer,** consulting engineer and **C. A. Johnson,** manager of sales, all with headquarters at Bethlehem, Pa. Mr. Walters was formerly manager of the fabrication and erection department of Bethlehem Steel, Mr. Mercer was chief engineer in that department, and Mr. Johnson was manager of sales of fabricated material. Mr. Marshall and Mr. Jones are continuing in the capacities which they held with the McClintic-Marshall Corporation under its previous ownership.

Personal

W. S. Boyce, assistant to the president of the **Railroad Supply Company,** has resigned, effective March 21.

George A. Long, manager of the **Industrial Brownhoist Corporation,** Cleveland, Ohio, has been transferred to Bay City, Mich, to succeed **J. Stanley See,** resigned.

Clark P. Pond, has been appointed vice-president, engineering and sales, of the **Truscon Steel Company,** Youngstown, Ohio. Mr. Pond was formerly connected in a similar capacity with **David Lupton's Sons Company.**

Reding Putman, at one time associated with the advertising and trade promotion department of the **Southern Pine Association,** has been appointed advertising manager of the **Wood Preserving Corporation,** with headquarters at Pittsburgh, Pa.

E. M. Vehmeyer, sales manager in the Detroit (Mich.) plant of **Joseph T. Ryerson & Son, Inc.,** has been appointed manager of the plant. **W. H. Basse,** formerly manager of the Detroit plant, has been transferred to Chicago where he will engage in special sales work.

W. R. Toppan, who has been identified with railroad water treatment for 22 years, has joined **The Permutit Company,** manufacturers of water-treating equipment, as railroad representative. Mr. Toppan's headquarters are at the main office of the Permutit Company, 440 Fourth Avenue, New York.

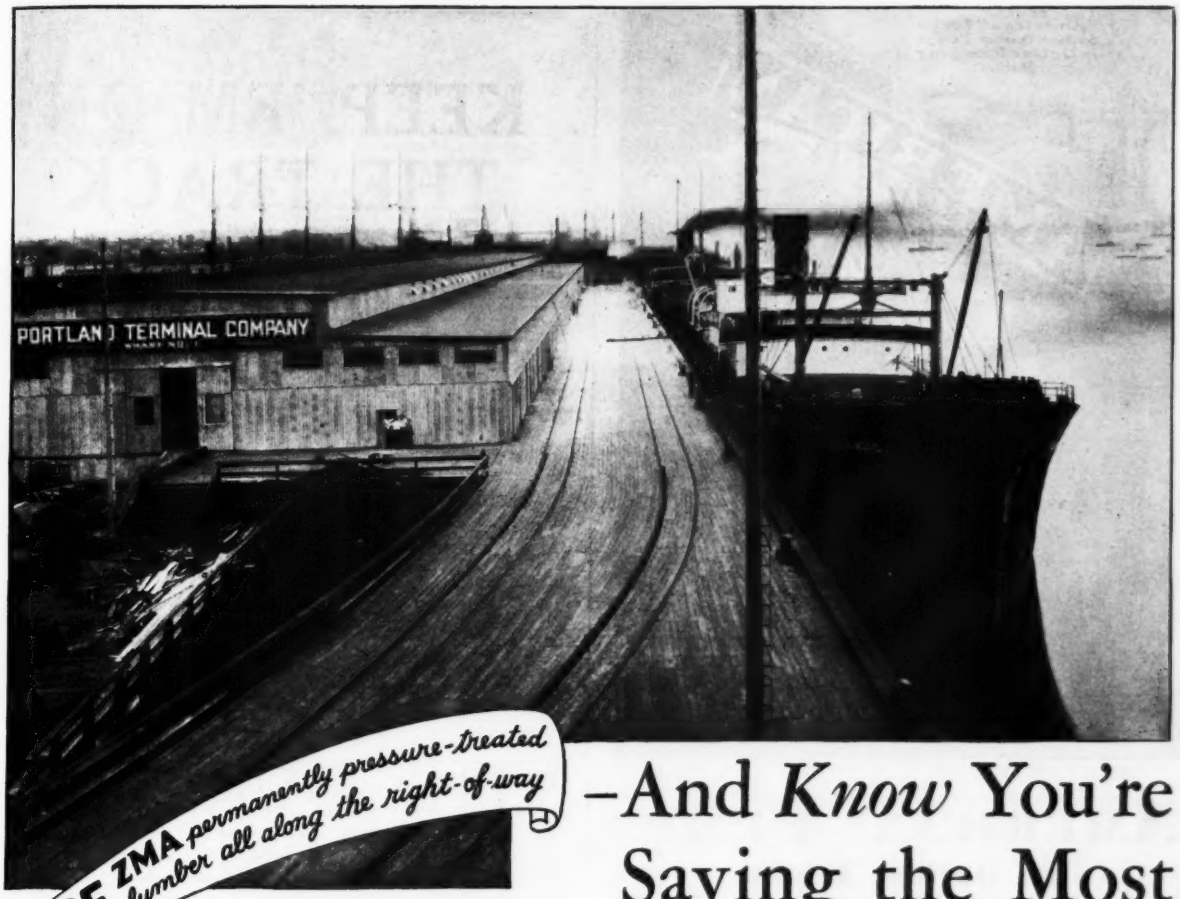
Orville P. Blake, district sales manager of the Inland Steel Company, Chicago, with headquarters at Kansas City, Mo., died at Denver Colo., on February 25. Mr. Blake joined the sales staff of this company in 1906 as manager of the St. Louis, Mo., office. He was transferred to Washington, D. C., during the war and to Chicago in 1919. His headquarters remained at the latter point until 1925 when he opened the sales office of the Inland Steel Company at Kansas City.

H. W. Renick, vice-president of the **Racor Pacific Frog & Switch Company,** Los Angeles, Cal., has been elected president to succeed **James B. Strong,** who has been elected vice-chairman, and who is also president of the **Ramapo Ajax Corporation.** Mr. Renick graduated from the University of Denver and later served in the engineering department of the Colorado & Southern and the Union Pacific. In 1910, he entered the service of the Elliot Frog & Switch Co., where he was placed in charge of sales and

H. W. Renick

engineering for the territory west of El Paso, Tex., and Salt Lake City, Utah. In 1916, he was transferred to East St. Louis, Ill., and in 1919 he resigned to become representative of Mudge & Co., the Elliot Frog & Switch Co., and several other railroad supply firms on the Pacific Coast. In October, 1921, together with his associates, Mr. Renick purchased the assets of the Magnetic Signal Company and formed a new corporation of which he was elected vice-president and later president. In 1924, he was appointed Pacific Coast representative of the Ramapo Ajax Corporation, and when this company established the Racor Works at Los Angeles in 1927 he became vice-president, which position he held until his recent election.

Pillar and Mast Jib Cranes—Booklet 316 which has recently been issued by the Industrial Brownhoist Corporation, Cleveland, Ohio, is devoted to describing and illustrating this company's line of pillar and mast jib cranes. The booklet contains 12 pages.



—And *Know* You're Saving the Most

Prevent wet rot, dry rot and white ants, and mechanical wear is the only thing left to be concerned about. In most places the mechanical wear is largely a matter of surface decay and will be almost entirely eliminated when the lumber is permanently protected against deterioration.

ZMA pressure-treated lumber is completely protected. It *comes* to the job protected and *remains* permanently protected. The treatment can't possibly get out. It is there to stay, inside and out.

Cleanliness is another important feature of ZMA pressure-treated lumber. The natural color of the wood is retained and it is both paintable and odorless.

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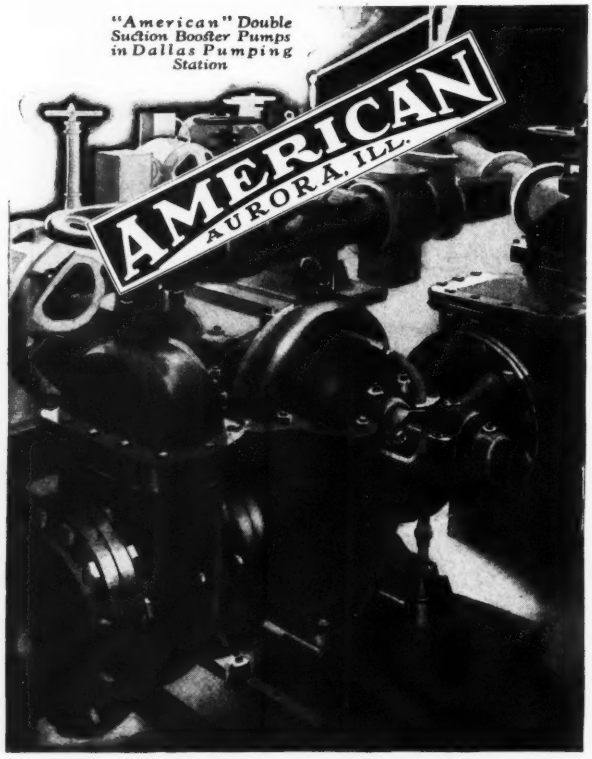

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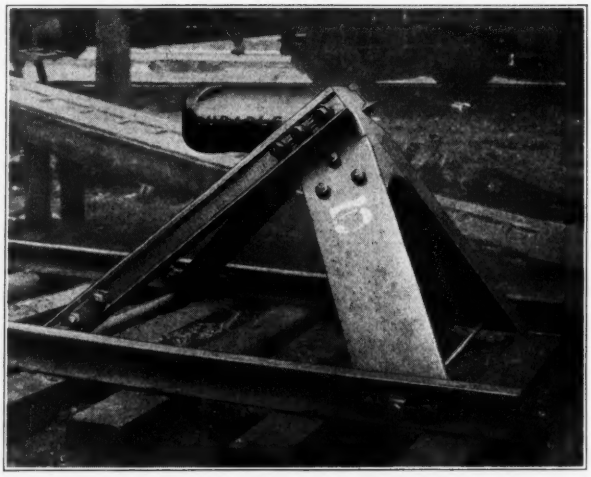
KEEP 'EM ON THE TRACK



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(Patented Aug. 3rd, 1920, Pat. No. 1348223, Other Patents Pending)

A Bumping Post for use in either freight or passenger service. Massive strength is combined in this bumping post with low initial cost, minimum occupancy of valuable track space, and real economy of installation, with no digging and only a few holes to drill in running rails, track bolt size.

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Like all DURABLE Bumping Posts, the Model D STOPS THE CARS. That's the real function of a Bumping Post.

Mechanical Manufacturing Company

Union Stock Yards, Chicago, Ill.

(Also Manufacturers of the Ellis Post)

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CREOSOTED SOUTHERN PINE

The name Creo-pine on creosoted southern pine is more than a trade mark. It is a pledge of honest, accurate manufacture and rigid inspection from standing tree to finished product. Back of it are 23 years of wood preserving experience.

Always Ready to Fill Rush Orders

for finest grade Cross Ties

Creo-Pine products include:

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a sturdy Page Fence *to withstand atmospheric conditions in your locality . . . .*

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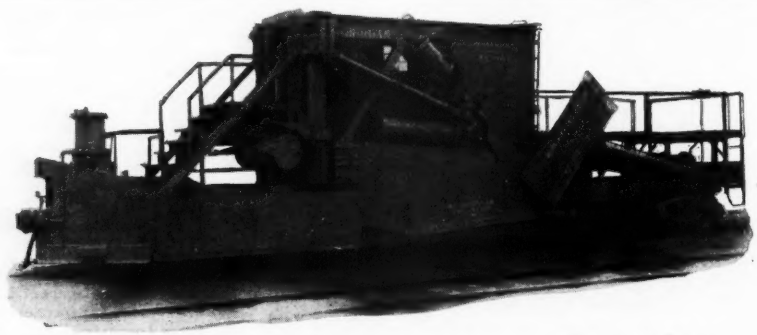

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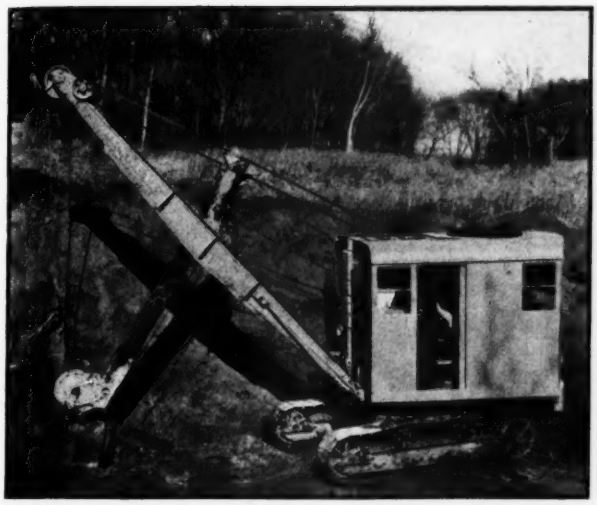

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all as required in a day's operation

Model O meets the urgent present-day need for a smaller—⅜-*yard*—revolving shovel-crane offering greater utility at lower cost.

Ruggedness is the dependable foundation upon which this Buckeye is built. From steel-treaded crawlers to manganese dipper, it is entirely capable of giving continuous service in varying materials and under shifting conditions. Rotating and traveling bases are sturdy, one-piece electric steel castings. Heavy-duty gasoline motor is mounted on a solid cast sub-base, forming a complete assembly with the radiator, clutch and two-speed transmission unit. 19-foot boom combines flexibility with strength, and is rigidly reinforced against side-wise distortion. A one-piece casting, the dipper has a capacity of .444 cubic yards, struck measure. Double dipper stick, of rectangular box construction, passes through inside of boom. Fast hoisting, swinging and crowding speeds are supplemented with easy, one-man control.

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The Anchor Engineer found that this Tractor could pull a load of Line Poles *but*

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DIXIE POLES ARE CUT FROM OUR OWN TIMBER

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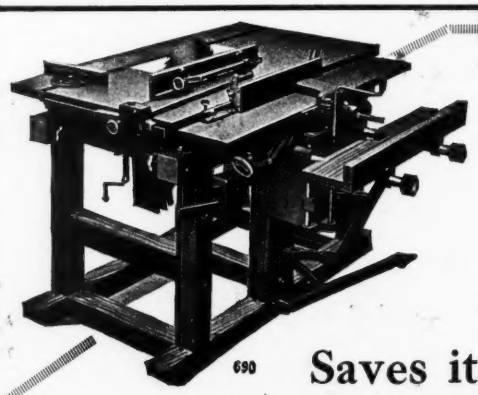

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No Refitting
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Just a steady pumping 'till the job is tight.

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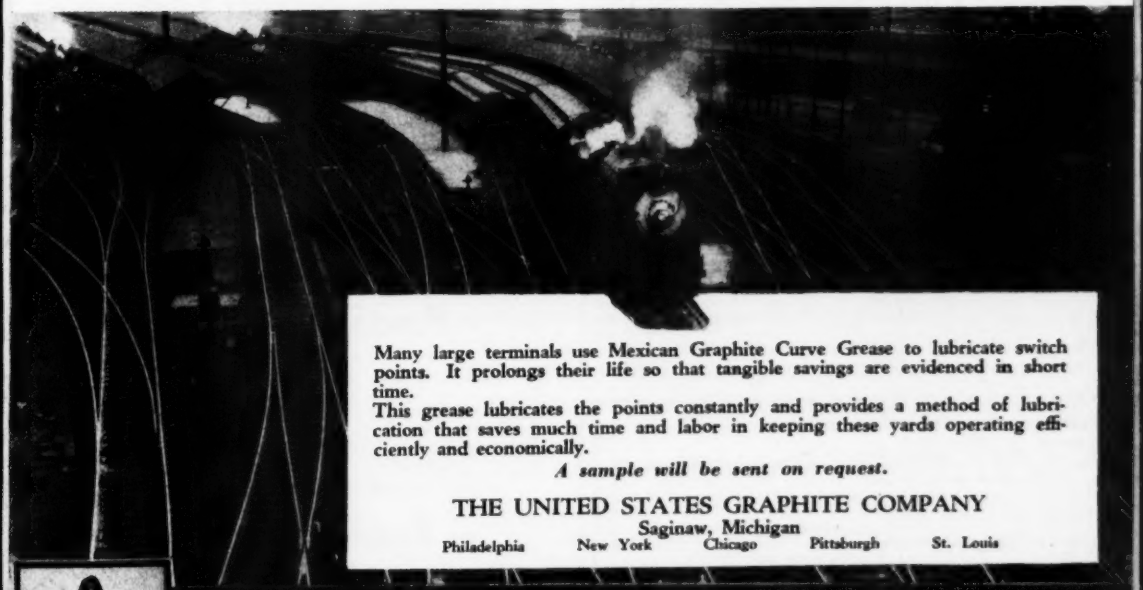

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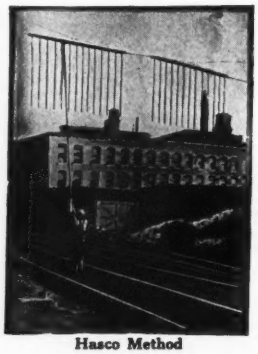

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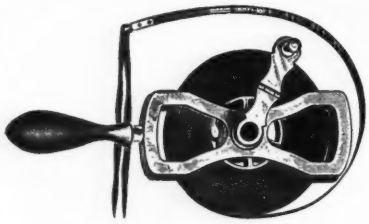

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Here are portable machine tools designed especially for railway track use. You will find them efficient and economical.

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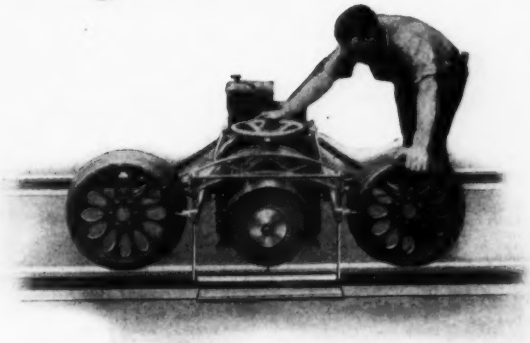
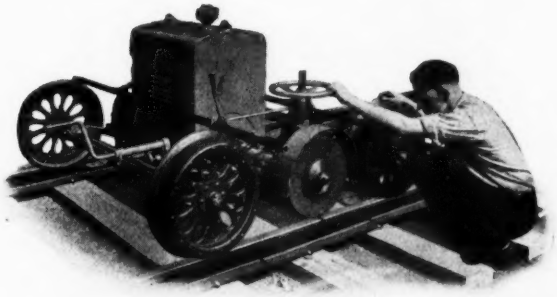


Model P-3



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Bedbugs, lice and fleas disturb the sleep, comfort and well-being of workers and thereby cause suffering, distress, dissatisfaction, greater labor turnover and reduced efficiency. Reduced efficiency, in turn, means lost motion, higher labor costs per job and delayed maintenance and construction work.

Railroad Calcyanide offers you immediate and certain relief from insects. The camp car, bunk car or other structure is left thoroughly clean—after one treatment.

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A CLEAN-UP JOB FOR THE P. R. R.

Out at the 20th Street Produce Yards, Pittsburgh, Pa., the above "Pittsburgh-Des Moines" Incinerator is daily destroying all rotten vegetable produce, and food wastes from dining cars for The Pennsylvania Railroad Company. This scientific destructor plant has a capacity of 50 tons of garbage and rubbish every 24 hours.

The P. R. R. Incinerator Plant was installed in 1929, and today is rendering the satisfied officials of the Pennsy's new enlarged freight produce terminal and yards an economical, reliable and steady performance—day in and day out.

Write today for the 20-page booklet "Railway Water Service" describing PDM Elevated Tanks, Standpipes, and Water Treating Plants for Railways.

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3474 Neville Island, Pittsburgh, Pa.
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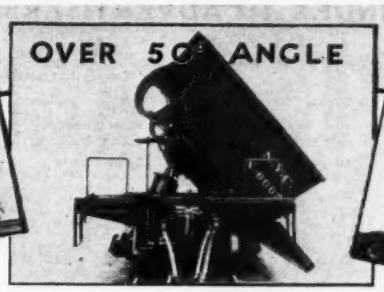


MAGOR Air Dump Cars have that unusual stamina to go on working day after day—year after year under all conditions of loading and unloading with absolute safety.
Low operating costs, dependability, and quick manipulation in service stand out boldly in the experiences of the many users of Magor Air Dump Cars.
Important reasons for their efficiency, economy and safety in service are:

Great Strength
Stability on Track
Selective Dumping
Free Floating Door
Low Loading Height
Dump Clear of Ballast

MAGOR CAR CORPORATION

50 Church St., New York

MAGOR *Automatic Air Dump* CARS

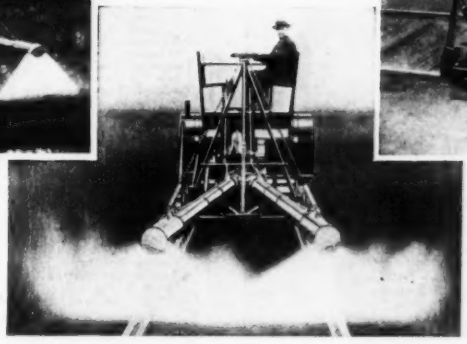
Arrange for a Demonstration of these Machines on *Your* Road!

The Giant "Octopus"

Woolery Control-Type Railway Weed Burner built in 3 and 5-burner types. The widest burning and most flexible machines yet produced. Outside burners may be swung in or out, up or down at the will of the operator while the machine is in operation. Each burner under separate and positive control. The long side arms may be swung out to burn to a width of 45 feet to burn out ditches and assure good drainage.

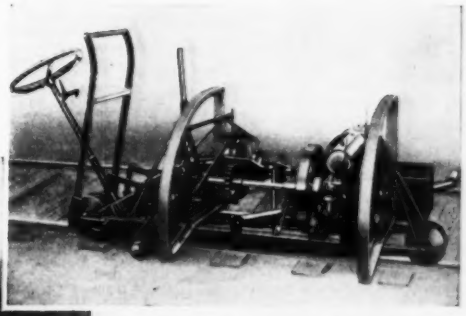
Think of it! A burning speed of from ½ to 15 miles per hour at a cost of from $3.50 to $6.00 per mile—twice over. And we guarantee to prove it at any time—anywhere—by a demonstration on your road at a time when vegetation is at its worst.

Be WOOLERY WISE



The Midget "Octopus"

The Chore Boy of the Rails. Specially adapted for short line railroads, street car companies, lumber companies, etc. Presents a solid wall of flame 10 feet wide or its long arms can be set to burn to a width of 18 feet. Every railroad should have a number of these machines for burning weeds and thawing switches around the yards.



Woolery Power Bolt Tightener

An automatic power machine for tightening bolts on rail joints, or for removing nuts from old bolts. It will tighten bolts on from 200 to 300 joints per day on existing track, and on from 150 to 200 joints when laying new rails. It will keep bolts tight for a longer period and lowers the cost of keeping them tight.

Read This Working Report From One of the Large Northwest Railroads:

Date	Hour Operation	Hours Helper	Number Joints	Gal. Gas Used
Oct. 12-29	8	8	210	3
Oct. 13-29	8	8	210	3
Oct. 14-29	8	8	215	3
Oct. 15-29	8	8	220	3
Oct. 16-29	8	8	220	3
Oct. 17-29	8	8	230	3

Send for Literature Illustrating and Describing These Machines in Detail

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Inventors and Manufacturers of Railway Maintenance Equipment

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Wharton, Jr. & Co., Wm.
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Anchor Post Fence Co.
Tubing, Seamless Steel
Timken Roller Bearing Co.
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Hastings Signal & Equipment Co.
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Armco Culvert Mfrs. Assn.
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Chipman Chemical Engineering Co., Inc.
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Oxweld Railroad Service Co.
Welding, Electric
Electric Railroad Sales Corp.
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American Steel & Wire Co.
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Armco Culvert Mfrs. Assn.
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Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Woolery Machine Co.
Wheels, Wrought Steel
Bethlehem Steel Co.
Carnegie Steel Co.
Windshields
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Fairmont Railway Motors, Inc.
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American Steel & Wire Co.
Anchor Post Fence Co.
Bethlehem Steel Co.
Page Fence Association
Wire, Welding
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See Preservation, Timber
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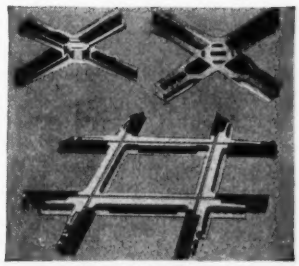

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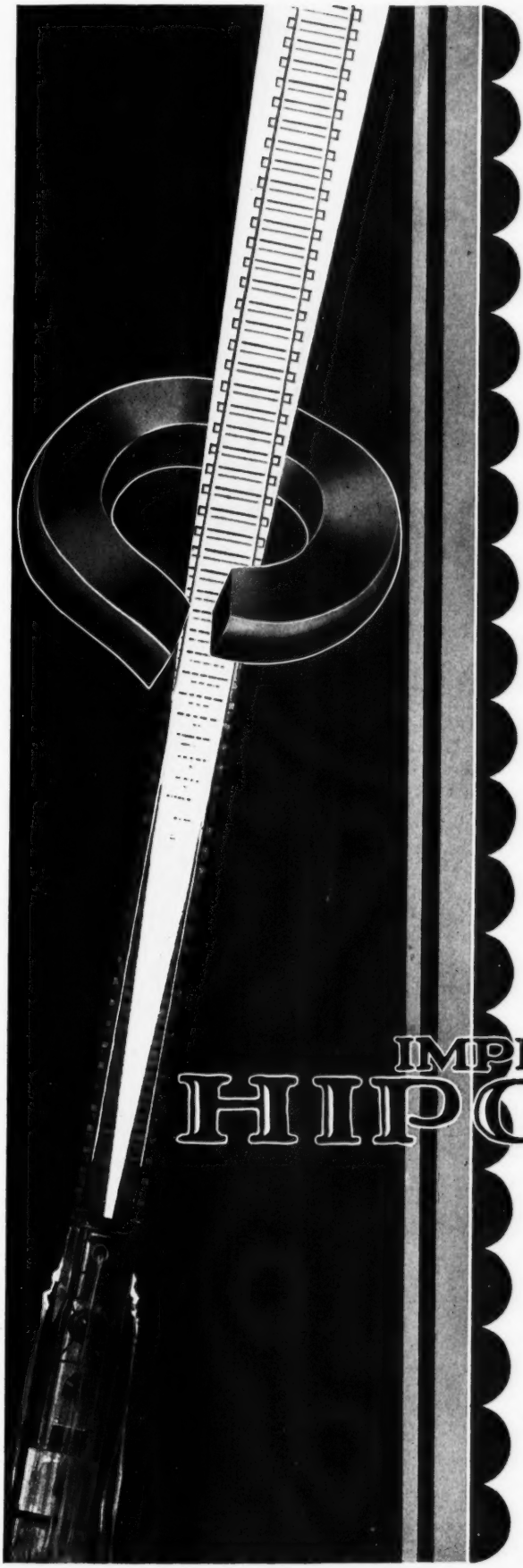

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